MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: H. H. KIMBALL.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for January, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian service, cable and mail, 8; River and Flood service, rainfall only, 49, river and rainfall, 162; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2944; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries and printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The month opened with a barometric disturbance of slight energy off the Texas coast. Moving northeastward, with increasing strength, this low pressure reached the lower Lake region on the morning of the 3d, and during that day it united on the New England coast with a storm of considerable intensity that apparently developed over the Carolinas during the 2d, and moved thence northeastward during the night of the 2–3d, attended on the middle Atlantic and south New England coasts by wind velocities of 30 to 48 miles an hour. Advisory messages in connection with this storm were telegraphed Atlantic ports from Hatteras to Eastport on the evening of the 2d, and warnings for high southeast winds were displayed on the Maine coast on the morning of the 3d.

The first important storm of the month on the Great Lakes advanced from the British Northwest Territory to the extreme upper Mississippi Valley during the 5th and 6th, with reported minimum barometric pressure 29.03 inches at St. Paul, Minn., at 8 p. m. of the 6th. During the 7th this storm moved south of east over the Lake region with barometer 29.02 inches at Grand Haven, Mich., at the morning report, and by the morning of the 8th had reached Nova Scotia. At 12:06 p. m. of the 8th the following message was cabled Lloyds, London:

> Severe storm will pass eastward from Newfoundland to-night.

The highest wind velocity reported in connection with this disturbance was 56 miles an hour at Cleveland, Ohio, during the night of the 7–8th. Snow fell generally from the upper Mississippi Valley over the Lake region and Ohio Valley, New York, and New England during the 7th, and a moderate cold wave swept southward over the central valleys and the Gulf States during the 7th and 8th, carrying the line of freezing temperature to the middle Gulf coast and northern Florida by the morning of the 9th. The snow, gales, and low temperature of this period were amply covered by the forecasts and special warnings.

The severest storm and cold wave of the month visited the central, southern, and eastern districts from the 10th to the 13th. This storm first assumed definite form over the lower valley of the Colorado River during the night of the 8th, and moved thence to the west Gulf States during the 9th and 10th with gradually decreasing barometric pressure. During the 11th the disturbance moved rapidly northeastward to the St. Lawrence Valley, attended by snow in northern and rain in southern districts east of the Mississippi River, and followed by clearing and much colder weather. On the morning of the 12th the line of zero temperature reached the Ohio River, and freezing temperature occurred to the middle coast of the Gulf of Mexico. By the following morning the line of freezing temperature had reached Tampa, Fla., and a minimum reading of 28° was noted at Jacksonville. On the Great Lakes a maximum wind velocity of 60 miles an hour, from the west, occurred at Buffalo, N. Y., and on the Atlantic coast a

maximum velocity of 60 miles an hour was reported at New York, N. Y., during the night of the 11th. The snow, gales, cold wave, and frost of the 11th to 13th were covered by the regular morning and evening forecasts and special warnings. Moving eastward over Newfoundland during the 12th, with barometric pressure below 29.00 inches, the storm reached the British Isles on the 16th. At 10:45 a. m. of the 12th the following message was cabled to Lloyds, London:

Severe storm will move eastward over Newfoundland to-day followed by a cold wave.

The most important storms of January, 1903, on the Pacific coast occurred in the third decade of the month. During the night of the 23d the barometer fell rapidly on the north Pacific coast and to 29.38 inches at Port Crescent, Wash. During the 24th the storm center moved inland over the British Northwest Territory with a barometer reading of 29.00 inches at Kamloops at the evening report, and high southwest winds and heavy rain prevailed along the Washington, Oregon, and northern California coasts. This disturbance rapidly lost energy during the 25th and practically dissipated over the Lake region during the 26th. The approach of another disturbance from the Pacific Ocean was indicated by evening reports of the 25th; on the morning of the 26th this storm was central over western Oregon. By the morning of the 27th, and during that and the following day, a depression of great magnitude extended from the middle Rocky Mountain districts to the middle and north Pacific coast. During the 28th this depression centered over eastern Colorado. During the next two days the storm center advanced, with a marked increase in intensity, over the Lake region and Ohio Valley, attended during the night of the 29th and on the 30th by gales of 40 to 60 miles an hour on the Great Lakes, and during the 30th and 31st by northwest gales along the middle Atlantic and New England coasts.

BOSTON FORECAST DISTRICT.

The month was unusually tempestuous, severe gales, with rain and snow, being of common occurrence along the coast. The most severe storms were those of the 10–11th, 17–18th, 20th–21st, and the 24–25th, the winds being from easterly quarters and of great force. Violent westerly gales were also of frequent occurrence. A noticeable feature of the high winds was their continuance, some of the gales lasting two or three days. Storm warnings were issued on fifteen days, and all were fully justified, excepting probably one. Beyond great delay, little damage resulted to shipping, which was doubtless due to the ample and timely warnings. The Bureau was highly commended for its excellent work.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

The weather during January was generally mild. Frost or temperature warnings were issued for the sugar and trucking interests in the coast section on the 2d, 5th, 6th, 7th, 8th, and 12th. Cold-wave warnings were issued for Louisiana and eastern Arkansas on the 11th. Storm warnings were issued on the 23d and advisory warnings were issued of brisk to high winds for the benefit of the small craft engaged in the oyster and fishing industry on the 11th, 21st, 26th, and 29th. Subsequent conditions showed that all warnings were justified.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

Advisory messages were sent to all open ports from time to time during the month in advance of impending windstorms. As no casualties occurred, it is thought that the information was of considerable advantage. The most severe and dangerous storm during January was one which advanced southeastward from the British Northwest Territories and reached the Lake region the night of January 6–7. This storm continued with considerable force for a period of thirty-six hours. Another severe storm advanced eastward from the Rocky Mountains on the 28th and 29th, increasing in force during the latter date and on the morning of the 30th. Marine interests were warned of the approach of both these storms.

No severe cold wave overspread the forecast district during the month, but the most general one was that which moved from the British Northwest Territories southward and eastward during the 28th, 29th, and 30th, for which warnings were issued in advance. Cold-wave warnings were ordered at a few stations on other dates, but not generally throughout the district.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

The prevailing mild weather during January was interrupted by only one cold wave, and that of local character and short duration. Light precipitation was a feature; traffic on the mountain railroads was not interrupted.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month can be readily divided into two essentially different types of pressure distribution. From January 1 until the 18th a seasonal high covered the western half of the country, and in this forecast district use was made of this knowledge to anticipate a period of dry weather with northerly winds, relatively low temperatures, and much tule fog in the great valley. From January 19 to the 31st entirely different seasonal pressure distribution occurred and rain or snow with continued southeast winds covering many days was anticipated.

On January 5 the map offered an excellent illustration of the conditions prevailing when the valleys of California are full of fog (tule fog). The surface temperatures ranged from 36° to 40°, while on the peaks and foot hills bright sunshine prevailed with temperatures 10° higher. At San Francisco the temperature was 42°, maximum, 52°; at Mount Tamalpais, 53°, maximum, 62°. It is interesting to note that these conditions lasted for several days. South of the Tehachapi unusually warm weather prevailed. As illustrating the contrast the following table may be cited:

Station.	Maximum.	Station.	Maximum.
Los Angeles	80°	Red Bluff	40°
San Luis Obispo	80	Sacramento	40
San Diego	76	Fresno	42

At the same moment, 5 p. m. January 5, there was a difference of 19° in temperature between San Francisco and Mount Tamalpais—14 miles away.

The fog continued in the great valley with little interruption for more than two weeks, moving slowly from the valley to the sea. On January 11 and subsequent dates the unusual conditions of killing frost and dense fog were reported at points in the valley.

A southwest storm warning was hoisted at San Diego on January 15 at 6 p. m. and was verified.

From January 19 to the end of the month storm warnings were displayed almost continuously on the northern coast of California. On January 21 the rainfall at Eureka from 10:25 p. m. of the 20th to 9:05 p. m. of the 21st amounted to 5.10 inches, being the greatest precipitation in any twenty-four consecutive hours since the establishment of the station.

High southwest winds prevailed in Nevada on January 24 to 26.

The rivers of the Sacramento Valley rose rapidly on January 27, but except at Colusa did not pass the danger line. Information of expected rise was sent nightly to the Colusa Sun.

A cold wave for northern Nevada on January 29 was not

forecast, although forecasts of much colder weather were sent to such points as could be reached. Reports from Carson City were not received on January 28.

The general rains for both northern and southern California were forecast, and no adverse comment has been made upon the work of the service. Some complimentary letters have been received.

The frosts in southern California on the morning of January 30 were accurately forecast.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The first half of the month was mild and dry, but on the 19th a stormy period began which lasted almost uninterruptedly during the remainder of the month. There were no cold waves during the month.

Timely warnings were issued for all storms, and no important casualties, due to stress of weather, occurred. The Norwegian bark, *Prince Arthur*, was wrecked January 2, on the northwest Washington coast, with a loss of 18 lives. It is supposed that the captain made a mistake in his reckoning as the ship was steered into the breakers during the night.

Unusually high winds prevailed at times along the Washington coast. At North Head, a maximum wind velocity of 76 miles from the southeast occurred on the 29th, and 64 miles an hour from the southwest was reported on the 23d from Tatoosh Island.

The warm rains during the middle of the month caused streams in western Oregon to overflow their banks, and flood warnings were issued between the 22d and the 31st. These warnings were accurate and of great value to the people living near the submerged districts, as well as to mill men and those interested in river navigation.—*E. A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	6, a. m.	48	123	9, p. m.	27	80	3,050	3.5	871	36.3
II	8, p. m.	53	108	11, a. m.	32	65	2,900	2.5	1,160	48.3
III	11, a. m.	53	108	14, p. m.	32	81	2,550	3.5	729	30.4
IV	13, p. m.	44	116	16, a. m.	35	85	2,100	2.5	840	35.0
V	16, p. m.	53	108	20, p. m.	46	60	2,700	4.0	675	28.1
VI	21, a. m.	32	106	22, p. m.	28	83	1,550	1.5	1,033	43.0
VII	27, p. m.	53	108	25, a. m.	48	88	2,100	3.5	600	25.0
VIII	28, p. m.	38	122	1, a. m.*	32	65	3,500	3.5	1,000	41.7
Sums							20,450	24.5	6,908	287.8
Mean of 8 paths							2,556		864	36.0
Mean of 24.5 days									835	34.8
Low areas.										
I	1, a. m.	29	95	4, a. m.	46	60	2,300	3.0	767	32.0
II	2, p. m.	51	120	5, p. m.	30	82	2,400	3.0	800	33.3
				7, a. m.	46	60	3,450	4.5	767	32.0
III	5 a. m.	54	114	9, a. m.	48	54	3,150	4.0	788	32.8
IV	9, a. m.	35	112	12, a. m.	47	65	3,000	3.0	1,000	41.7
V	16, a. m.	48	89	18, a. m.	47	65	1,225	2.0	612	25.5
VI	18, p. m.	51	114	22, a. m.	46	60	2,925	3.5	836	34.8
	20, p. m.	28	83				1,800	1.5	1,200	50.0
VII	20, p. m.	51	120	24, a. m.	48	54	3,300	3.5	943	39.3
VIII	21, p. m.	51	120	24, a. m.	38	85	2,350	2.5	940	39.2
IX	24, a. m.	48	124	26, p. m.	46	87	1,975	2.5	790	32.9
X	27, a. m.	39	120	30, p. m.	48	68	2,900	3.5	828	34.5
Sums							30,775	36.5	10,271	428.0
Mean of 12 paths							2,565		856	35.7
Mean of 36.5 days									843	35.1

* February.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

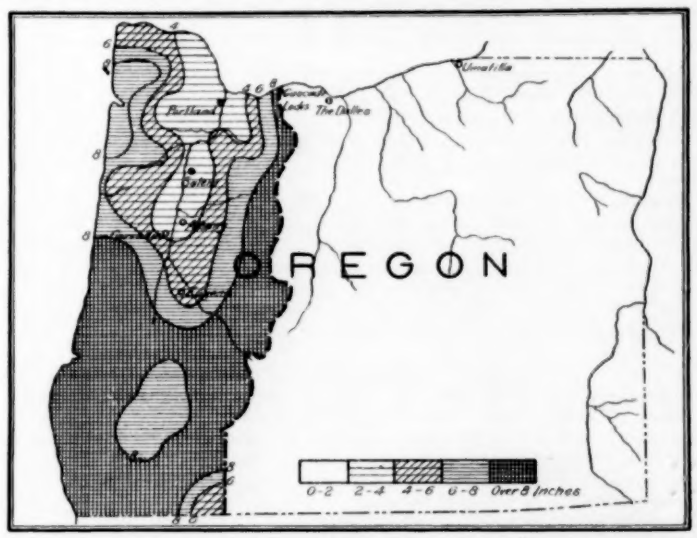
RIVERS AND FLOODS.

There was some slight southern extension of the ice limit during January, but not so great as during the corresponding period of 1902. There was also a considerable increase in the thickness of the ice in the rivers of the northern districts, Moorhead, Minn., reporting 32 inches, as compared with 18 inches at the close of the preceding month.

Nothing of special interest was noted except in the rivers of South Carolina and the north Pacific district. In the former State the rivers were above the normal winter stages during the entire month, and warnings were issued on the 4th for danger-line stages in the Wateree, Pedee, and Congaree rivers. The stages reached in the two former rivers were from 2 to 3 feet above the danger lines, but no damage was reported.

The following report of the flood in the Willamette River of Oregon was prepared by Mr. E. A. Beals, Official in Charge of the Weather Bureau office at Portland, Oreg.:

Up to the 18th the weather in Oregon during January, 1903, was not especially noteworthy, but on that date a rainy spell, accompanied by warm weather, set in, which lasted a full week. The rainfall was very heavy up to the 25th, after which date the weather turned colder and most of the precipitation occurring later was in the form of snow.



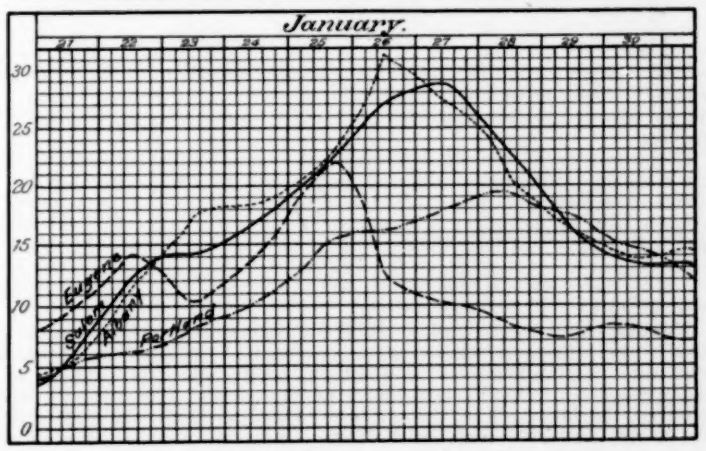


FIG. 1.—Precipitation in western Oregon from January 17 to 25, 1903, inclusive.

The rains were heaviest in the southern half of western Oregon, and on the 24th a number of stations in this section reported amounts as high as 3 inches or more, while for the period between January 17 to 24, inclusive, the rainfall ranged from 8.62 inches at Drain, to 14.29 inches at Buckhorn Farm, near Kerby. In the lower portion of the Willamette Valley the rainfall was considerably lighter, being generally between 3 and 4 inches.

The streams in western Oregon began to rise rapidly on the 21st and the evening weather report contained the following announcement:

"Heavy rains have fallen in southern Oregon, and the river at Eugene

is rising rapidly. Should there be any danger of a freshet in the lower Willamette River special reports will be obtained Thursday and the public notified."

The river rose rapidly during the next few days and finally reached a stage of 22.0 feet at Eugene, on the 25th; 31.5 feet at Albany, on the 26th; 29.0 feet at Salem, on the 27th, and 19.3 feet at Portland, on the 28th. Accurate and timely warnings were sent to up river points on the 24th and 25th, and the public in Portland were equally as well informed of the stages about to occur in the lower end of the valley.

The chart of rainfall and the hydrographs below it, fig. 1, show graphically the cause of the flood together with the stages reached at the river stations reporting to this center.

The flood caused widespread damage of the usual character though very fortunately no lives were lost. Railroad beds were washed out; bridges, houses, barns, and outbuildings were carried away; millions of feet of logs were torn from their moorings and carried down the river; farm lands were overflowed, and much live stock and other portable property destroyed. The damage, however, could not have been prevented, and was limited to property that could neither be removed nor protected when the warnings were issued.

The highest and lowest water, mean stage, and monthly range at 162 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during January are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau, and are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—Precipitation deficient, but rains so frequent as to retard all farm work. Oats slightly damaged by cold during middle of month. Last week warm enough to cause fruit buds to swell. Oats and wheat promising. Some corn and cotton land being prepared, and preparations for early trucking crops getting under way during last decade.—*F. P. Chaffee.*

Arkansas.—The weather was generally unfavorable for plowing and preparing the ground for the coming season's crop, and very little work of this nature was done. Considerable late matured cotton remained in the fields at the month, but on account of the weather conditions and the nearness of the time to prepare the ground for the next season's crop, much of this will remain ungathered. Winter wheat and oats appeared to be in good condition. Fruit trees were apparently uninjured.—*Edward B. Richards.*

Arizona.—Cold weather prevailed during part of the month, and the temperature was generally above the normal. There was a decided deficiency of precipitation, and at many stations there was none whatever. The cold weather caused some damage to growing crops, and plowing was delayed somewhat by frozen ground. As a rule, however, agricultural prospects in this territory were excellent. In many localities they were reported to be the best for years. The ranges were in good condition and grain was doing well.—*M. E. Blystone.*

California.—Cold, cloudy, and foggy weather continued until about the 20th, greatly retarding the growth of all vegetation. A few days of warm weather, accompanied by heavy rain, toward the close of the month caused a rapid growth of grain and grass and greatly benefited orchards. The heavy rain in northern California caused a rapid rise of creeks and rivers, damaging grain and other property to some extent.—*Alexander G. McAdie.*

Colorado.—In the mountain districts, in common with the plains region, dry weather characterized the first and second decades of January. The last decade, however, was stormy, while the precipitation was generally greater than for January, 1902, yet in only a few localities on the different watersheds was the total brought near the normal. The snow is packed hard in huge drifts in the gulches and timber, where it has been swept by the prevailing high winds; the outlook was favorable to a steady flow of water.—*F. H. Brandenburg.*

Florida.—The month was favorable for vegetables, except on some low lands, where the soil was too wet. Cabbages, irish potatoes, tomatoes, and other vegetables were available in goodly amounts. Celery made poor progress, owing to unseasonably warm weather. The coldest weather occurred during the first decade, when freezing conditions prevailed to the lower portion of the central district. Citrus trees were well advanced, some showed bloom. Peach trees, generally, were in bloom. Some corn was planted during the last decade.—*A. J. Mitchell.*

Georgia.—The temperature for the month was below the average, but the weather was not at any time severe. The 13th was generally the coldest day. The 29th was very warm for the season. The rainfall was below the normal in the northern and middle sections and slightly above in the southern. The month was characterized by a preponderance of cloudy and rainy days. Winter wheat and oats passed through the month favorably. Stock was reported in good condition. Plowing was well advanced for the season in some of the central counties. The outlook for fruit at the close of the month was propitious.—*J. B. Marbury.*

Idaho.—Fair weather, with moderately low temperature, prevailed from the 5th to 16th. From the 17th to close of the month daily precipitation occurred in nearly all parts of the State. Heavy snow fell on all the mountains and in high plateau sections, consequently the accumulated snow at the close of January was the greatest for at least the past five years. Winter stock ranges were covered with snow to an unusual depth, necessitating more general feeding of stock than for many years. Fall sown wheat had a good snow protection.—*S. M. Blandford.*

Illinois.—The weather was remarkably mild, except a brief cold spell from the 8th to the 13th. The average temperature was slightly above normal. Precipitation was deficient but well distributed. The average condition of wheat was good; some injury to the crop ensued in the southern district from alternate freezing and thawing. The rye crop was thriving. Conditions were favorable for meadows and grasses. Fruit trees remained uninjured.—*W. G. Burns.*

Indiana.—Wheat was well protected by snow during the greater part of January and when, near the last of the month the ground became bare, the crop, with few exceptions, was found to be in excellent condition. The exceptions were fields that had been planted prior to September 25 and damaged by flies before winter began. The weather and condition of the ground were not favorable for field work, and considerable corn remained unhoused at the close of the month. Live stock of all kinds was wintering in good condition.—*W. T. Blythe.*

Iowa.—The month was unusually favorable for stock feeding and for gathering the unharvested portion of the corn crop. Fall wheat and rye, of which a very small acreage was sown, was not materially damaged by freezing weather.—*John R. Sage.*

Kansas.—The mild weather was favorable to outdoor work and corn husking progressed rapidly; some plowing was done in the south the latter part of the month. Wheat looked well but needs moisture.—*T. B. Jennings.*

Kentucky.—The condition of wheat was generally encouraging at the end of the month. In the western portion of the State some fields in low, wet land seemed to have been injured somewhat by freezing and thawing, but in the central and eastern portions it looked very promising. Very little work was done in preparing tobacco beds. Farm stock was in good condition and feed was fairly plentiful. Fruit trees appeared to be doing well.—*H. B. Hersey.*

Louisiana.—Unfavorable weather for agricultural interests prevailed during the greater part of the month. Frequent showers kept the ground too wet for tillage, and preparation for planting spring crops progressed slowly. There was too much rain for sugar cane, and it was feared that a continuation of wet weather will injure seed cane. Preparations for rice seeding were pushed as rapidly as possible. Winter truck gardens have made splendid growth. The weather was favorable for oranges.—*I. M. Cline.*

Maryland and Delaware.—Temperature normal; precipitation abundant and fairly well distributed. Winter growth received ample and protective snow covering in the northern and western counties, but in the south and east the ground was bare most of the month. Wheat was in fine condition in the first-named area; elsewhere early sown was fair, barring local injury by fly; late sown wheat was injured somewhat by frequent freezing and thawing. Grasses were in good condition. Ground was generally too wet for farm work.—*Oliver L. Fassig.*

Michigan.—The weather conditions during January were favorable for winter wheat and rye; the ground was well protected with snow until the 27th, when it was partly uncovered by rains in portions of the central and southern sections. There was very little alternate freezing and thawing, and correspondents, as a rule, reported little or no damage of any kind. The wheat plant was rather small on account of the late seeding last fall, but appeared green and healthy. On account of ample snow protection during the most severe weather there was very little frost in the ground.—*C. F. Schneider.*

Minnesota.—The maximum temperatures occurred for the most part on the 6th and 26th, and the minimums on the 11th and 30th. The minimum temperatures were not at all low for January. Snow covered the

State the whole of the month, the depth ranging from about 6 inches in the open country to much greater depths in the timbered regions. Work in the logging camps was considerably hindered by the accumulations of snow. The gathering of a splendid ice crop has been going on practically the whole month, the thickness in places being 30 inches.—*T. S. Outram.*

Mississippi.—There were only two periods of marked abnormal temperature; one, the coldest period of the month, obtained from the 9th to the 14th, and the other, the warmest period, prevailed from the 26th to the 29th, inclusive. The precipitation was well distributed throughout the month and over the State. Excessive rainfalls were not so frequent as usual. A light snow and sleet storm occurred in the central and southern counties on the 14th.—*W. S. Belden.*

Missouri.—In most sections of the State the weather was unfavorable for winter wheat. Except in a few of the northeastern counties the crop received but little protection from snow, and in portions of the central and southern sections it was injured to some extent by alternate thawing and freezing. In most of the northern counties, however, wheat was reported in good condition at the close of the month.—*A. E. Hackett.*

Montana.—January was an unusually mild month; ranges in portions of the Milk and Missouri River valleys were covered with hard crusted snow; conditions very favorable elsewhere.—*Montrose W. Hayes.*

Nebraska.—The warm, dry weather allowed rapid progress to be made in gathering corn, and the crop was about all secured at the end of the month. The ground was covered with snow during a very small portion of the month; however, the high temperature and absence of severe wind made it a most favorable month for fall sown grain. Winter wheat was affected but little by the weather, and with but few exceptions was reported in excellent condition.—*G. A. Loveland.*

Nevada.—The weather of the month was remarkably fine and clear during the first and second decades. The last decade, however, was more or less stormy, with good rains in the valleys and heavy snows on the mountain ranges. At the close of the month the depth of snow in the canyons and gulches was considered amply sufficient to maintain a normal flow of water during the summer months. The weather conditions were generally favorable to stock interests.—*J. H. Smith.*

New England.—The weather was somewhat warmer than usual, with the temperature above normal in about all sections. The precipitation was about normal and was well distributed throughout the month and over the district. The weather was fairly favorable to outdoor pursuits, and especially for lumbering and ice interests. Reports from sections in Connecticut indicate that peaches were probably injured by the extremely low temperatures of December.—*J. W. Smith.*

New Jersey.—The prevailing weather conditions were unfavorable to winter grain, as the ground was bare of snow from the 1st to 6th, and from 12th to 25th; much freezing and thawing occurred. Wheat and rye were deadened slightly at the tops and the fields looked yellow, but no serious injury has been done. Fruit trees were in good condition.—*Edward W. McGann.*

New Mexico.—A mild month with good weather. Although unusually dry, all reports indicate that stock retained good condition. West of the Rio Grande and throughout the central part of the Territory the soil was moist to a considerable depth.—*R. M. Hardinge.*

New York.—Conditions generally favorable for wheat and rye, most sections reporting ample snow protection, but some damage by sudden temperature changes. Very little frost in ground. General rains and thaw from 27th to 29th.—*R. G. Allen.*

North Carolina.—Frequent rains, absence of snow covering, and alternate freezing and thawing were rather unfavorable for wheat, but the injury was slight, owing to the excellent start the plants had secured. Crops in lowlands were injured by excessive moisture. At the close of the month early seeded winter wheat, oats, and rye were healthy and vigorous, good stands were secured, and the plants were spreading nicely. Late seeded cereals, however, made comparatively little growth. Prospects remain exceptionally favorable.—*C. F. von Herrmann.*

North Dakota.—The month was warmer than usual, with but little snow until the latter part, when heavy snow fell in nearly all sections of the State. Owing to this covering of snow on the ground feeding of stock, that had before grazed on the prairies, became necessary.—*B. H. Bronson.*

Ohio.—Temperature and precipitation slightly deficient. Wheat continued in excellent condition; it was well protected by snow during all of the cold weather and no injury whatever was reported. The snowfall was generally less than normal for the month, but the weather turning cold after each storm caused it to remain on the ground for a considerable period of time to the benefit of grain and grass. Fruit buds were uninjured. Stock was in good condition.—*B. L. Waldron.*

Oklahoma and Indian Territories.—Moderately cool weather and below average precipitation, except during the last week, tended to retard crop growth, yet wheat was well rooted, and wheat, winter rye, and volunteer oats made good progress. Plowing for corn, oats, and early potatoes was well advanced. Stock continued on wheat or range and did well, except in the Choctaw Nation, where conditions were unfavorable and considerable loss was reported. Cotton picking continued. Fruit trees were reported in good condition—*C. M. Strong.*

Oregon.—In the western section of the State the first half of the month was favorable for plowing and some progress was made with this work. Not much seeding, however, was done, as, before the ground was properly prepared, a rainy spell set in and farm work came to a standstill. In the eastern section practically no plowing or seeding was done during the month. Fall wheat in portions of Umatilla and Union counties is thought to have been damaged in places by alternate thawing and freezing, and it is estimated that about a fourth of the crop will have to be reseeded. Elsewhere fall wheat came up nicely, although its growth has been unusually slow. Winter pasturage was the poorest for a number of years.—*Edward A. Beals.*

Pennsylvania.—No protracted warm or cold spells occurred. The average precipitation was slightly above the normal, about an inch greater than that for the same period last year, and the heaviest for any January since 1898. The ground was fairly well covered with snow in nearly all agricultural districts during the coldest weather, and the conditions were in the main favorable to winter grain and grasses. No complaints of severe weather injuring fruit prospects were received.—*T. F. Townsend.*

Porto Rico.—Weather generally favorable, except a little too dry for very young crops and recently planted seed toward the end of the month. Young canes have done well and the maturing ones have improved. Grinding has become quite general, with fairly satisfactory results. The sowing, the cultivating, and the cutting of tobacco was carried on successfully, excepting the delay occasioned by the dry weather near the end of the month. Coffee trees pruned and put in order for the new crop; prospects good for early flowering. Small crops generally good and abundant but in need of rain; pasturage excellent.—*E. C. Thompson.*

South Carolina.—Temperature conditions as well as precipitation were favorable for trucking interests near the coast, while in the interior wheat and oats were uninjured and maintained a very promising condition. Country roads were, as a rule, in bad conditions, restricting the hauling of fertilizers. Some tobacco beds were prepared and seeded, but plowing was impracticable.—*J. W. Bauer.*

South Dakota.—The precipitation was comparatively light, and considerable of the month was more pleasant than usual. Except west of the one hundred and first meridian, compacted December snowfall remaining on the ranges materially interfered with the winter grazing of live stock and caused some slight loss of unacclimated cattle. A severe northwest gale on the 6th damaged some windmills and small farm outbuildings, two men and some cattle being killed in a barn that was wrecked, and in several towns damaged some chimneys and weak structures.—*S. W. Glenn.*

Tennessee.—The first half of the month was cold, with light rains and snow; the second half warmer, with but little rain, but the weather was generally cloudy. Alternate freezing and thawing had a bad effect on winter grain, especially late sown, causing much injury in the western division. Early sown grains acquired good root before the severe frosts and withstood them well. Low temperatures were beneficial in checking growth. Clover was in fair condition; but little plowing was done.—*H. C. Bate.*

Texas.—Showers were frequent during the month and the distribution of precipitation was normal, being heaviest over the eastern and southeastern districts and lightest in the western and northwestern counties. No pronounced changes in temperature were recorded, and so far the winter has passed without the prevalence of severe freezes. The soil and subsoil are thoroughly stocked with moisture, the precipitation for the preceding fall and winter months being the heaviest since records of such data began. Wheat and other cereals continued to make vigorous growth and were in excellent condition and stooling well; there was minor injury reported to wheat by insects and excessive precipitation in limited areas in the north-central portion. The breaking of land was very backward, but at the close of the month was well under way. Limited acreage was seeded to oats and corn during the month, and in the extreme southern counties preparations for cotton planting were in progress. Extensive shipments of vegetables were made during the month, and strawberries were on the market. Stock continued to winter very satisfactorily.—*Edward H. Bowie.*

Utah.—Very little farm work was done during the month. The heavy precipitation gave the ground a good soaking. Fall grain continued in fair condition and most of it had a good covering of snow at the close of the month. Stock generally continued in fair condition.—*L. H. Murdoch.*

Virginia.—The temperatures obtaining throughout the month were about normal, while the precipitation was in excess and came mainly as rain. Crop progress was much retarded by the soaked condition of the ground, and in some localities rust was reported in the winter wheat and oats. The hessian fly was in evidence in some fields in the southwestern part of the State, but the damage from this source was small.—*Edward A. Evans.*

Washington.—The month was notably mild, especially in the first decade, when heavy rains fell, greatly swelling the streams and causing floods. There was no severe weather to injure wheat, although there may have been slight damage by alternate thawing and freezing. Snow covered the ground at the end of the month.—*G. N. Salisbury.*

West Virginia.—During the period of hardest freezing wheat was generally well protected by a good covering of snow, but, during the second cold spell there was not much snow, and the late sown wheat was damaged slightly. At the close of the month, wheat was reported to be in good condition, as were also rye, oats, and grass. Practically no plow-

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, January, 1902.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	43.8	−1.0	Prattville	84	29	Hamilton, Riverton	10	13	3.56	−1.18	Daphne	5.61	Burkville	1.95
Arizona	46.4	+1.4	Champies Camp	81	6	Fort Defiance	−2	1	0.11	−1.14	Prescott	0.74	12 stations	0.00
Arkansas	40.2	−0.4	Texarkana, Warren	80	29	Eureka Springs, Oregon	7	12	2.59	−1.57	Lake Village	5.29	Silver Spring	0.42
California	46.6	+0.4	Indio	90	14	Bodie	−19	29	4.56	+0.30	Crescent City	24.38	8 stations	0.00
Colorado	25.9	+1.8	Blaine	73	28	Gunnison	−35	1	0.45	−0.28	Ruby	4.73	2 stations	0.00
Florida	57.2	−0.2	Flamingo	88	25	Holt, Wausau	18	9	5.24	+2.71	Fort Meade	9.14	Bonifay	3.15
Georgia	44.6	−0.8	Fleming	87	29	Diamond	11	12	3.29	−0.82	St. Marys	6.70	Waynesboro	1.32
Idaho	26.2	+0.9	Garnet	60	24	Dickey	−19	28	2.78	+0.64	Silver City	7.86	Pollock	0.53
Illinois	27.0	+0.5	Centralia	70	28	Philo	−12	13	1.36	−0.82	Olney	2.94	Antioch	0.35
Indiana	27.3	−1.6	3 stations	67	29	Topeka	−21	12	2.28	−0.52	Bloomington	4.44	Topeka	0.83
Iowa	23.0	+3.5	Belknap	60	1	Clear Lake	−12	11	0.28	−0.74	Fort Madison	1.46	8 stations	T.
Kansas	32.2	+3.1	Englewood	76	6	Moran	−8	12	0.33	−0.42	Columbus	1.15	4 stations	T.
Kentucky	34.8	−0.5	Williamsburg	82	30	Williamstown	−9	12	2.50	−1.62	Owenton	3.78	Franklin	1.44
Louisiana	48.8	−2.0	4 stations	84	26–29	Ruston	14	12	5.37	+0.47	Amite	9.76	Farmerville	2.54
Maryland and Delaware	31.6	−0.4	Annapolis, Md	62	28	Boettcherville, Md., Grantsville, Md	−6	14, 19	3.99	+1.05	Bachmans Valley, Md.	6.08	Denton, Md	2.39
Michigan	20.7	−0.2	Traverse City	55	1	Humboldt	−32	14	1.77	−0.39	Cassapolis	4.45	Eagle Harbor	0.21
			Dundee, Grape		29									
Minnesota	11.3	+1.0	New Ulm	45	6	Pokegama Falls	−39	14	0.45	−0.22	Moorhead	1.18	Rolling Green	T.
Mississippi	45.0	−1.6	Walnut Grove	83	29	Ripley	12	13	5.20	−0.20	Thornton	8.45	Holly Springs	3.41
Missouri	31.5	+1.1	Caruthersville	*73	29	Appleton City	−11	12	1.36	−0.69	Caruthersville	3.45	Rockport	0.06
Montana	25.7	+4.5	Augusta	63	5	Glendive	−39	28	0.82	−0.22	Summit	8.50	Poplar	T.
Nebraska	27.0	+6.1	Aurora	63	25	O'Neill	−14	11, 12	0.22	−0.38	Gordon	0.80	5 stations	0.00
						Agee, Purdum								
Nevada	32.0	+5.1	Rioville	72	26	Potts	−16	29	1.81	+0.68	Lewers Ranch	7.40	Rioville	0.11
New England	22.8	+1.1	Hartland, Vt	57	2	Van Buren, Me	−37	25	3.56	−0.32	Durham, N. H	6.05	Patten, Me	1.60
New Jersey	30.4	+0.3	5 stations	57	3,28,30	Layton	−5	14, 20	3.90	+0.24	Paterson	5.04	Layton	2.31
New Mexico	35.0	+1.6	Roswell	80	28	Taos	−1	20	0.22	−0.36	Fort Bayard	0.78	Lordsburg	0.00
New York	22.8	+0.7	Otto	53	30	Adirondack Lodge	−38	19	2.91	+0.15	Number Four	6.16	Auburn	0.89
North Carolina	40.0	−0.2	Rockingham, Washington.	73	29	Linville	1	13	3.71	−0.48	Statesville	6.43	Asheville	1.61
North Dakota	9.4	+2.7	Fort Yates	56	6	Cando	−37	12	0.66	+0.23	Berlin	1.65	McKinney	T.
Ohio	27.1	−1.1	Hanging Rock, Portsmouth.	73	29	Milligan	−13	10	2.36	−0.27	Lancaster	4.25	Swanton	0.94
Oklahoma and Indian Territories.	39.2	+1.4	Ural, Okla	81	28	Blackburn, Okla., Fairfield, I. T	6	11, 12	0.59	−0.57	Tulsa, I. T	2.10	4 stations	T.
Oregon	37.2	+2.2	Heppner	66	6	Pine	−8	16	8.37	+2.47	Glenora	28.39	Umatilla	0.33
Pennsylvania	26.9	−0.6	California	68	29	Dyberry	−13	20	3.31	+0.15	Seisholtzville	5.09	Erie	1.49
Porto Rico	74.2	+0.3	Morovis	92	21	Adjuntas	48	6	1.54	−2.71	Maunabo	4.73	Coamo	T.
South Carolina	48.7	−1.1	Yemassee	77	29	Liberty	13	13	3.85	+0.37	Georgetown	7.10	Walhalla	2.40
South Dakota	17.7	+0.8	Spearfish	62	5	Pine Ridge	−24	12	0.23	−0.18	Sisseton Agency	0.69	6 stations	T.
Tennessee	38.6	+0.4	Ashwood	77	29	Erasmus	1	9	2.95	−1.89	Iron City	5.52	Leadville	1.20
Texas	48.2	−0.2	Fort Ringgold	91	29	Paris	12	13	2.33	+0.14	Trinity	5.49	Amarillo	0.12
Utah	27.0	+0.6	St. George	66	5	Woodruff	−21	29	1.40	+0.62	Huntsville	7.72	2 stations	0.00
Virginia	35.3	−0.1	Bigstone Gap	68	29	Stanardsville	0	13	3.63	+0.54	Lynchburg	5.31	Cape Henry	1.93
Washington	35.6	+2.4	Mattingers Ranch	60	3	Republic	2	26	4.72	+0.68	South Bend	18.83	Sunnyside	0.17
West Virginia	31.8	0.0	Echo	79	29	Travellers Repose	−7	19	3.21	+0.05	Pickens	6.45	Summerville	1.55
Wisconsin	16.0	+1.8	Brodhead	55	29	Grantsburg	−29	11	0.51	−0.88	New Holstein	1.60	Florence	T.
Wyoming	24.2	+1.9	3 stations	60	5, 6, 15	Border	−27	12	0.77	+0.15	Thayne	2.65	Hyattville	0.00

ing was done during the month. Stock was generally in good condition, with prospect of sufficient feed.—*E. C. Vose.*

Wisconsin.—The temperature conditions during the month were slightly above normal, with no unusually sudden or pronounced changes decidedly cold weather prevailed during the second and third decades, but there was generally sufficient snow on the ground to protect winter crops. The precipitation was deficient throughout the State, but was heaviest over the east-central counties. However, no serious deficiency in moisture was reported from any point.—*J. W. Schaeffer.*

Wyoming.—No severe storm was general over the State during the month, but over the southwestern and southern sections snow was quite general during the last decade of the month. The snowfalls of the months of December and January have furnished a good stock of snow for irrigation water the coming season, except over the northeastern portion of the State, where a marked deficiency of snow existed at the close of the month.—*W. S. Palmer.*

SNOWFALL AND WATER SUPPLY IN THE ROCKY MOUNTAIN REGION.

The following extracts are taken from the snow bulletins for January, 1903, prepared by the Section Directors of Climate and Crop sections in the Rocky Mountain region:

Colorado.—In the mountain districts, in common with the plains region, dry weather characterized the first and second decades of January, but the last decade was stormy. Although the precipitation was generally greater than for January, 1902, yet in only a few localities on the different watersheds was the total brought near the normal. The snow is in excellent condition for a steady flow, as it is hard packed in huge drifts in the gulches and timber, where it has been swept by the prevailing high winds.

Idaho.—The heavy falls of snow during November and December were equaled or exceeded by the January snowfall, consequently the accumulated snow lies to an unusual depth on all the mountains of the State. An abundance of water for all purposes is assured without further snow during the remainder of the winter. Farmers throughout the irrigation districts are elated with the prospect of an abundance of water for crops during the coming crop season, while lumbermen and farmers in northern counties fear high water when the snow begins to melt.

Montana.—On the west side of the main divide the snowfall was somewhat greater than on the east side. In Flathead County drifts are deep and firm in the mountains, but there is not much snow in the valley; it was melted by chinooks, but froze before reaching the streams. The Bitter Root Valley is covered with 3 to 10 inches of snow, and the mountains in Ravalli County are heavily covered. The fall was light in Granite County and was unevenly distributed in Deer Lodge and Powell counties—being above normal in some localities and much below in others. In western Missoula County there is an average amount of snow and the fall has been quite heavy in the mountains; there is but little in other portions of the country.

Nevada.—Reports indicate that the stock of snow now in the mountains over the watersheds of the State is amply sufficient to maintain a normal flow of water next summer without further precipitation during the remainder of the winter. Stockmen and ranchers are correspondingly happy over the fine prospects for a good crop season.

New Mexico.—It seems to be the consensus of opinion that with the exception of the watersheds of the Canadian and tributaries, the present season thus far shows a better prospect for an abundant water supply in the streams of the Territory than for some years past. At the close of January there was very little snow lying on the ground below 8000 feet. Above 10,000 feet, in the northern mountains, the average depth was from 3 to 4 feet on north sides, but on south and east sides there were frequent bare spots. However, the exceedingly heavy winds during the last week in January, although a potent evaporating agent,

doubtless proved more advantageous than otherwise by filling the mountain canyons with the drifting snow. With the exception of the northeastern quarter of the Territory, which has been unusually dry throughout the past fall and winter, the prairie soil at the present writing is in very good condition for the early start of spring grass, and there is every prospect for a good water supply.

Utah.—The snowfall of the month was excessive over the Great Salt Lake and the Sevier Lake watersheds and deficient over the watersheds of the Green and Colorado rivers. The fall over the Great Salt Lake watershed was remarkably heavy and exceeds that for any January since 1890. The depth of snow in the mountains of the State is generally above average and greater than for several years. High winds during the month caused the snow to drift nicely and the temperature conditions were favorable for packing. The amount of snow now in the mountains and its drifted and solid condition assure all sections of the State an abundant supply of water for irrigation throughout the whole of the coming crop season.

Wyoming.—The January snowfall was very unevenly distributed throughout the State, the northern and extreme eastern portions receiving but small amounts, while the western and southern counties received good falls. The marked deficiency of snow over the eastern slope of the Big Horn Mountains, noted in the December bulletin, still continues and reports from that section show that probably less than one-half of the usual depth now exists. Reports from the Laramie, Platte, Green, and Snake River watersheds show that a good stock of snow has already accumulated in the sections named, and depths are reported to be up to the average or above; in many localities the depths are much above the normal and a good supply of water for irrigation seems assured.

SPECIAL CONTRIBUTIONS.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, January, 1903.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		≈				
1	29.94	64	63.3	77	69	60.5	68	ne.	3	2	30.04	29.94	0.01
2	29.95	62	61.3	77	63	63.3	80	ne-n.	1-0	4	30.09	29.90	0.00
3	29.96	64	63.3	77	62	59.7	78	w.	1-0	3-0	30.00	29.91	0.00
4	30.04	67	59	76	62	63.0	84	w-nne.	0-3	6	30.07	29.94	0.02
5	30.08	65	57	72	66	52.0	59	nne.	4	4	30.14	30.04	0.00
6	30.04	60	56.5	72	62	52.0	63	ne.	3	3	30.10	30.02	0.00
7	29.90	70	64	74	56	55.0	67	e.	1-0	5-10	30.07	29.90	0.02
8	29.73	72	69.3	77	62	62.7	70	ssw.	3-4	8-2	29.92	29.72	0.22
9	29.92	63	59	75	67	62.3	77	w-nw.	4-0	10-2	29.91	29.72	0.00
10	29.90	67	64	75	57	56.5	74	nw.	1-0	3-0	29.98	29.86	0.00
11	29.87	69	68.5	75	59	66.3	86	se.	1-0	10	29.98	29.85	1.65
12	29.97	67	61.5	76	69	68.3	91	sw-w.	1-0	10-4	29.98	29.85	0.16
13	29.97	68	60.5	73	64	55.3	63	nne.	3	1	30.02	29.94	0.00
14	29.97	67	63	74	66	57.0	67	nne.	3	4-1	30.02	29.94	0.00
15	29.96	68	64	73	63	60.7	78	ne-n.	2-5	9-3	30.02	29.92	0.02
16	30.00	68	64.3	74	66	63.3	80	ne.	3	4	30.03	29.93	0.02
17	30.00	65	64	77	65	63.3	78	ne-se.	3	3	30.06	29.97	0.00
18	30.04	66	65.5	78	64	65.5	85	s.	2-0	4-1	30.07	29.97	0.00
19	30.06	62	60.7	78	65	66.0	85	s.	1-0	3	30.10	30.01	0.00
20	30.08	69	65.3	79	60	61.5	79	s.	0	3	30.14	30.01	0.00
21	30.07	71	65.5	79	63	65.3	80	s-e.	0	4	30.16	30.04	0.00
22	30.10	69	64	79	66	62.3	68	se-e.	1-0	5	30.16	30.07	0.00
23	30.05	65	62	78	63	61.7	74	se.	1-0	3	30.13	30.03	0.00
24	30.04	69	64	77	62	62.7	80	s-ne.	2-0	8-2	30.14	30.02	0.00
25	30.02	66	62.5	76	64	60.7	70	ne.	2	2	30.11	30.00	0.00
26	29.99	69	62	78	66	60.3	70	ne.	2-0	2	30.08	29.98	0.00
27	29.99	67	65.3	76	65	60.0	67	nne.	3-0	5-2	30.06	29.95	1.27
28	30.10	69	61	72	65	61.7	82	nne.	1-5	2-6	30.13	29.99	0.42
29	30.14	69	60.5	73	66	57.5	68	ne.	5-6	10-6	30.18	30.07	0.12
30	30.15	69	61	73	65	54.0	58	ne.	6-7	7	30.19	30.12	0.12
31	30.15	70	62	74	65	56.5	62	ne.	6-5	7	30.22	30.10	0.00
Sums.													4.05
Means.	30.006	67.0	62.7	75.5	63.5	60.5	73.8		2.1	4.5	30.074	29.958	
Departure.	+.055					−2.2	−3.0			+0.1			+0.95

Mean temperature for January, 1903, (6 + 2 + 9) ÷ 3 = 69.8; normal is 70.2. Mean pressure for January, 1903, (9 + 3) ÷ 2 = 30.02; normal is 29.965.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) ÷ 4. ≈ Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

GENERAL SUMMARY FOR JANUARY, 1903.

Honolulu.—Temperature mean for the month, 69.8°; normal, 70.2°; average daily maximum, 75.5°; average daily minimum, 63.5°; mean daily range, 12.0°; greatest daily range, 19.0°; least daily range, 5°; highest temperature, 79°; lowest, 56°.

Barometer average, 30.020; normal, 29.965; highest, 30.22, 30th; lowest, 29.72, 8th; greatest 24-hour change, that is, from any given hour on one day to the same hour on the next, 0.17; lows passed this point on the 7th and 26th; highs on the 4th, 21st, and 30th.

Relative humidity average, 73.8 per cent; normal, 76.8 per cent; mean dew-point, 60.5°; normal, 62.7°; mean absolute moisture, 5.89 grains per cubic foot; normal, 6.27 grains. There was again an unusual period of low dew-point at the end of the month. Dew on grass, 12 mornings.

Rainfall data for January, 1903.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.
HAWAII.			OAHU.		
HILO, e. and ne.	*Feet.*	*Inches.*		*Feet.*	*Inches.*
Waiakea	50	3.39	Punahou (W. B.), sw.	47	4.05
Hilo (town)	100	4.46	Kulaokahua (Castle), sw.	50	2.56
Kaumana	1,250	.....	Makiki Reservoir	120	3.36
Pepeekeo	100	7.14	U. S. Naval Station, sw.	6	0.91
Hakalau	200	8.88	Kapiolani Park, sw.	10	2.30
Honohina	300	10.87	College Hills.	175	2.70
Puuohua	1,050	20.52	Manoa (Woodlawn Dairy), e.	285	5.75
Laupahoehoe	500	13.76	Manoa (Rhodes Gardens)	360	7.37
Ookala	400	11.34	School street (Bishop), sw.	.....	.....
HAMAKUA, nc.			Insane Asylum, sw.	30	2.93
Kukaiau	250	12.96	Kamehameha School	75	.....
Paauilo	300	11.42	Kalihi-Uka, sw.	485	6.95
Paauhau (Mill)	300	8.42	Nuuanu (W. W. Hall), sw.	50	2.86
Honokaa (Muir)	425	9.07	Nuuanu (Wyllie street)	250	3.86
Honokaa (Meinicke)	1,100	.....	Nuuanu (Elec. Station), sw.	405	4.05
Kukuihaele	700	11.44	Nuuanu (Luakaha), c.	850	9.64
KOHALA, n.			U. S. Experiment Station	350	3.21
Niulii	200	.....	Laniakea (Nahuina)	1,150	5.26
Kohala (Mission)	521	3.72	Tantalus Heights	1,360	3.71
Kohala (Sugar Co.)	270	2.50	Waimanalo, ne.	300	4.00
Hawi, Mill	700	2.81	Kaneohe	100	3.90
Puakea Ranch	600	2.88	Maunawili, ne.	300	6.73
Puuhue Ranch	1,847	10.10	Ahuimanu, ne.	350	6.79
Waimea	2,720	6.23	Kahuku, n	25	1.54
KONA, w.			Waialua	37	1.96
Holualoa	1,350	.....	Wahiawa	900	.....
Kealakekua	1,580	4.92	Ewa Plantation, s.	60	1.39
Napoopoo	25	3.62	U. S. Magnetic Station	45	1.28
Hoopuloa	1,650	2.74	Waipahu	200	0.42
KAU, se.			Moanalua	15	4.46
Kahuku Ranch	1,680	.....	KAUAI.		
Honuapo	15	0.82	Lihue (Grove Farm), e.	200	1.85
Naalehu	650	2.40	Lihue (Molokoa), e.	300	2.30
Hilea	310	1.40	Lihue (Kukaua), e.	1,000	2.22
Pahala	850	3.20	Kealia, e.	15	1.23
Moaula	.....	.....	Kilauea, ne.	325	2.40
Volcano House	4,000	4.24	Hanalei, n.	10	3.51
PUNA, e.			Waioli	10	3.66
Olaa, Mountain View (Russel)	1,690	6.38	Haena	15	.....
Kapoho	110	11.07	Waiawa	32	2.22
Pahoa	600	7.15	Eleele	150	1.87
MAUI.			Wahiawa (Mountain)	3,000	6.95
Lahaina	40	0.20	McBryde (Residence)	850	3.16
Waiopae Ranch	700	.....	Lawai (Gov. Road)	450	2.03
Kaupo (Mokulau), s.	285	4.31	Lawai, w.	225	1.20
Kipahulu, s	308	5.07	Lawai, e.	800	1.50
Nahiku, ne	.....	18.99*	Kola	100	0.71
Nahiku	1,600	.....	*Delayed December reports.*		
Haiku, n.	700	12.20	Wahiawa (Oahu)	.....	10.15
Kula (Erehwon), n.	4,500	3.04	Hawi (Kohala)	.....	13.91
Kula (Waiakoa), n.	2,700	2.35	Laupahoehoe	.....	27.20
Puuomalei, n.	1,400	16.05	Waiopae	.....	4.99
Paia	180	12.32	Nahiku	1,600	44.31
Haleakala Ranch	2,000	.....			
Wailuku, ne.	250	7.32			

* Record from 1st to 20th only.

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Rainfall, 4.05 inches; normal, 3.10 inches; rain record days, 12; normal, 16; greatest rainfall in one day, 1.65 inches, on the 11th; total at Luakaha, 9.64 inches; normal, 9.15 inches; total at Kapiolani Park, 2.30 inches; normal, 2.00 inches.

The artesian well level rose during the month from 34.57 to 35.06 feet above mean sea level. January 31, 1902, it stood at 33.95. The average daily mean sea level for the month was 9.71 feet, the assumed annual mean being 10.00 feet above datum. For January, 1902, it was 9.90.

Trade wind days, 15 (5 of north-northeast); normal, 14. Average force of wind during daylight, Beaufort scale, 2.1. Average cloudiness, tenths of sky, 4.5; normal, 4.4.

Approximate percentages of district rainfall as compared with normal: Hilo, 65 per cent; Hamakua, 160 per cent; North Kohala, 70 per cent; Waimea (Hawaii), 170 per cent; Kona, 140 per cent; Kau, 50 per cent; Puna, 50 per cent; Maui, southeast exposures, 100 per cent; north exposure, 200 and over; Oahu, about 100 per cent; Kauai, 55 per cent.

The heaviest rainfall for the month was 20.52 inches; Puuohua (Nahiku, 1660 feet), not heard from; heaviest 24-hour rainfall, 6.94 inches, Nahiku, 850 feet, 13th.

Mean temperature table.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.
	Feet.	°	°	°
Pepeekeo	100	75.4	66.3	70.1
Waimea	2,730	73.6	53.6	63.0
Kohala	521	75.1	62.9	68.3
Waiakoa	2,700	70.6	53.6	61.5
United States Magnetic Station	50	77.5	61.6	69.0
United States Experimental Station	350	76.3	64.5	69.8
Tantalus	1,725	71.1	59.3	64.5
Hilo	40	80.2	64.0	71.4

Kohala, Bond, dew point, 61°; relative humidity, 77 per cent; United States Magnetic Station, dew point, 61.0°; relative humidity, 75 per cent.

The month was characterized by two principal storms, the rains of the 11th from southeast and the rain of the 27th followed by a northerly gale. The coincidence of these, with corresponding storms in the previous month, is worth noting.

Heavy surf on Hawaii windward coast, 1st to 6th, 9th, and 27th to 31st.

Earthquake noted at Hilo, Waimea, and Kohala on the 3d between 7:20 and 7:25 a. m.

Solar haze and afterglow occasionally remarked.

No lightning noted.

The month of January was stormy throughout the Pacific judging from reports of vessels traveling here; northeasterly storms appeared to have extended even south of the equator.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Science. New York. Vol. 17.

Ward, R. DeC. Report of the Chief of the Weather Bureau. [Note.] Pp. 235–236.

Ward, R. DeC. Similar Barometric Variations over Large Areas. [Note on investigations of Norman Lockyer, W. S. Lockyer, and F. H. Bigelow.] P. 236.

Ward, R. DeC. Winter Aridity Indoors. [Note on article by Mark S. W. Jefferson.] P. 236.

Scientific American Supplement. New York. Vol. 55.

Walker, E. O. Atmospheric Electricity and Earth Currents. Pp. 22658–9.

Nature. London. Vol. 67.

MacDowall, Alex. Sun-spots and Summer Heat. P. 247.

Jensen, H. I. Remarkable Meteorological Phenomena in Australia. Pp. 344–345.

Engineering News. New York. Vol. 49.

—— The Movement of Sand on Beaches by winds of different velocities. [Note on observations by Mr. James H. Bacon.] P. 117.

Aeronautical Journal. London. Vol. 7.

Shaw, William Napier. Contributions of Balloon Investigations to Meteorology. Pp. 8–13,

National Geographical Magazine. Washington. Vol. 14.

Murdoch, L. H. Why Great Salt Lake has fallen. Pp. 75–77.

American Journal of Science. New Haven. 4th series. Vol. 15.

Barus, C. Ionization of Water Nuclei. Pp. 105–121.

La Nature. Paris. 31me Année.

Gall, J. F. Installation météorologique de l'hôpital de Pau. P. 128.

Ciel et Terre. Bruxelles. 23me Année.

Rocquigny-Adanson, G. de. Époque de la floraison du "Camellia japonica L." dans le centre de la France. Pp. 537–546.

Rocquigny-Adanson, G. de. Sur l'origine des "Mistpoeffers." P. 581.

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Maurer, Hans. Deutsch-Ostafrika. Pp. 1–20.

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—— Bericht über die internationale Experten-Konferenz für Wetterschiessen in Graz. Pp. 151–166.

—— Der Drachenaufstieg am 6 Dezember 1902 von aëronautischen Observatorium bei Berlin. Pp. 183–184.

Laska, W. Das Wetter und die Telegraphendrahte. Pp. 184–185.

Das Wetter. Berlin. 20 Jahrgang.

Frenbe, —. Ein landwirtschaftlicher Wetterdienst. Pp. 2–8.

Assmann, Richard. Der Gang der Isotherme 0° im Verlaufe des diesjährigen Winters. Pp. 8–19.

Meteorologische Zeitschrift. Wien. Band 19.

Liznar, J. Ueber die Aenderungen des Grundwasserstandes nach den vom Prälaten Gregor Mendel in den Jahren 1865–1880 in Brünn ausgeführten Messungen. Pp. 537–543.

Maurer, H. Das Klima von Deutsch-Ostafrika. Pp. 543–548.

Stolberg, A. Verhalten der Rheintemperaturen in den Jahren 1895–1900. Pp. 548–552.

Draenert, F. M. Zum Klima des Staates Ceará, Brasilien. Pp. 522–560.

—— Resultate der meteorologischen Beobachtungen zu Carmen (Patagonien) im Jahre 1900. P. 560.

Exner, F. M. Versuch einer Berechnung der Luftdruckänderungen von einem Tage zum nächsten. P. 560.

—— Meteorologische Beobachtungen auf der Insel Martinique im Jahre 1899. P. 561.

—— Temperatur der Lena bei Golowskaja. Pp. 561–562.

Steiner, L. Zum "Flächensatz." Pp. 562–564.

—— Giusseppe Zettwuch über die blaue Farbe des Himmels. Pp. 564–565.

Woeikof, A. Intensität und Dauer der Platzregen. Pp. 565–566.

—— Deformationen der Sonnenscheibe und grüner Strahl beim Sonnenuntergang. P. 566.

—— Auffallende Abenddämmerung. P. 566.

Shaw, W. N. La lune mange les nuages. Pp. 566–570.

Richter, C. M. Das Klima von Santa Barbara. Pp. 570–574.

—— Ueber die Beziehung des Luftdruckes an Stationen der Ostseite des Atlantischen Oceans. Pp. 574–575.

—— Partielle Regenmessung. P. 575–576.

—— Sonnenfinsterniss-Meteorologie. Pp. 576–577.

—— Die Anticyklone Sibirien. P. 577.

Duffek, —. Bemerkungen zur Frage über Vorgänge bei Gewittern. Pp. 577–578.

—— Die effektive Temperatur der Sonne. Pp. 578–580.

Rörig, Adolf. Waldungen und Hagelfälle. Pp. 580–581.

H[ann], J[ulius]. Magnetische Beobachtungen in Aegypten 1893–1901. P. 581.

—— Meteorologische Beobachtungen in Kete-Kratyi, Togo. Pp. 581–583.

Mouromtzoff, Peter von. Merkwürdige Hagelform. P. 583.

Memorias y Revista de la Sociedad Cientifica "Antonio Alzate." Mexico. Tome 13.

Guzman, José. Utilidad de las variaciones barométricas en el pronostico del tiempo. Pp, 215–230.

SYNCHRONOUS CHANGES IN THE SOLAR AND TERRESTRIAL ATMOSPHERES.

By Prof. FRANK H. BIGELOW.

Read before Section A, Astronomy and Astrophysics, American Association for the Advancement of Science. Washington, D. C., December 28, 1902.

GENERAL REMARKS.

In my paper, "A contribution to cosmical meteorology," published in the MONTHLY WEATHER REVIEW for July, 1902, evidence was given of the fact that the variation in the solar output, as registered in the relative frequency of the sun spots, has a marked synchronism with the variation of the areas inclosed by the curves representing the horizontal magnetic force of the terrestrial field. This is of course well known from many investigations, but the special features of the paper showed that the sun spots constitute only a sluggish register of the solar activity, and that the terrestrial magnetic force exhibits a set of characteristic minor fluctuations superposed upon the general 11-year curve. These special variations reappear with marked distinctness in the solar prominences as measured by their observed frequency, and also in the variations of the mean annual barometric pressures in all portions of the earth. The significance of this exhibit is its indication that the pressures in the earth's atmosphere are undergoing changes in short cycles of about three years average duration, which correspond with the changes in the external work of the sun. A further study of our meteorological records during the past few month convinces me that these short cycles are produced by modifications in the general circulation of the earth's atmosphere, which produce alternate accelerations or retardations of general movements, and that these raise or lower the average annual barometric pressure over large districts of the earth's surface. There is also a sort of surging of the atmosphere with more or less stationary configurations or structures, and these involve the so-called seasonal climatic changes of weather by which one year differs from another. Thus, the regions about the Indian Ocean and South America vary synchronously but inversely; the continental and the ocean areas appear to change in an inverse manner; there seems to be a tendency to generate a great cyclic change having a period of about eight years within which the pressure excesses begin, for example in India, pass through Asia, Europe, North America, and South America back to India. This synchronism between the solar and terrestrial variations is found in the United States to hold for the pressures, temperatures, the storm-track movements in latitude and longitude, the cold-wave tracks, and generally for all the elements of the atmosphere. I have elsewhere sufficiently described my views regarding the causes of this synchronism, and it must be evident to all that meteorology has a great interest in elucidating these fundamental problems of solar physics, since our hope of making seasonal forecasts of the weather will be fulfilled only by reducing our knowledge of the complex connections between the sun and the earth to a scientific basis. I can at this time present the result of only one portion of my work in this direction, with an indication of the nature of the problems that must be solved by astrophysicists in order to perfect our knowledge of terrestrial meteorology.

DISTRIBUTION IN LONGITUDE.

It is desirable to study the distribution of the effects of the solar activity at the surface of the sun in both longitude and latitude, and their variations in the 11-year period. Passing over the subject of the true period of the sun's rotation, which is now being discussed by scientists, and which would require a longer statement than is here possible, it may be noted that whatever period is adopted for an ephemeris, the frequency numbers for spots, faculæ, and prominences collected in tables will show a drift to the right or left according as the period is too short or too long. For example, if in constructing an ephemeris one adopts as the mean period of rotation that which is proper to the sun spots at latitude $\varphi = 12°$, which is 25.23 (siderial) days with the diurnal angle 14.27°, as Spörer and Wolfer have done, and collects together the faculæ in longitude, it is found that charts of successive rotations of the sun on this ephemeris show a trend to the right for the years 1887–1889, but a trend to the left in the years 1890–1892. This is due to the fact that just preceding the minimum of the solar-spot and faculæ period, these formations occur chiefly in low latitudes, within 5° to 10° of the solar equator, but after the minimum in latitudes 20° to 25°. In the former set the rotational period is much shorter than in the latter, that preceding minimum being shorter, and that following minimum being longer, than the period at 12° latitude. Thus Wolfer finds the diurnal angle of rotation 14.41° (or rotational period 24.98 days) in latitude 5°, but 13.92° (with period 25.86 days) in latitude 22°, as against 14.27° (with period 25.23 days) in latititude 12°.[1]

Wolfer's charts show a distinct trend to the right for the spots, faculæ, and prominences during the years 1887–1889, but to the left for the years 1890–1892. In the case of the prominences, which occur in all latitudes of the sun, we may expect to have an opportunity to discuss the surface rotation in higher latitudes than those of the spots and faculæ, since these are confined to the zones $\pm 30°$. I am engaged in such compilation of the data of the prominences observed in Italy from 1871 to 1900, but am not able to make any further statement at present. It is evident that whatever fundamental rotation period may be selected it can be corrected by the tabular drift as just indicated. There is to be noted, however, an important feature of the distribution in longitude as given on Wolfer's charts, namely, that the recurrence of the spots and faculæ does not happen at random in all degrees of longitude, that is on all solar meridians, but they are arranged in two well defined group systems, which repeat themselves during many rotations, and these are located approximately on the extremities of a single diameter, that is, they occur on meridians about 180° apart. There seems to be a solar meridian plane on which the output is constitutionally more vigorous, or as Wolfer indicates the fact, the sun has centers of activity on opposite sides of its mass. This peculiar distribution along the equatorial belt would seem to imply that

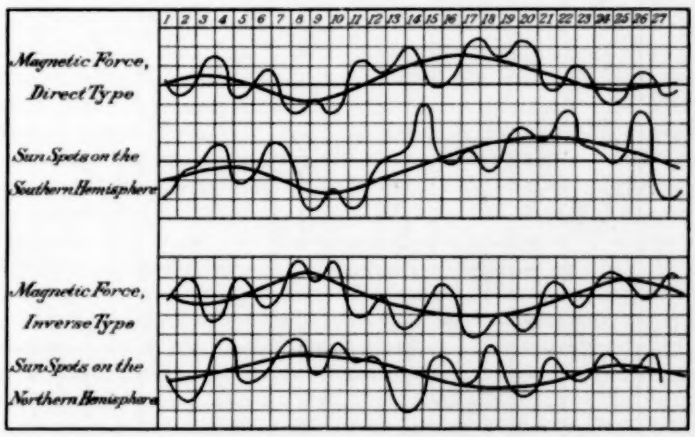

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Magnetic Force, Direct Type
Sun Spots on the Southern Hemisphere
Magnetic Force, Inverse Type
Sun Spots on the Northern Hemisphere

FIG. 1.—Comparison of the total sun-spot areas, 1854–1891, with the magnetic curves in the 26.68-day period.

the mass of the sun tends to erupt more freely on opposite sides of the center along one of its diameters, and this may lead to some knowledge or inference as to its physical interior condition. It may be a viscous mass somewhat elliptical in

[1] Publikationen der Sternwarte des Eidg. Polytechnikums zu Zurich. A. Wolfer. Bd. I, II, III. 1897, 1899, 1902.

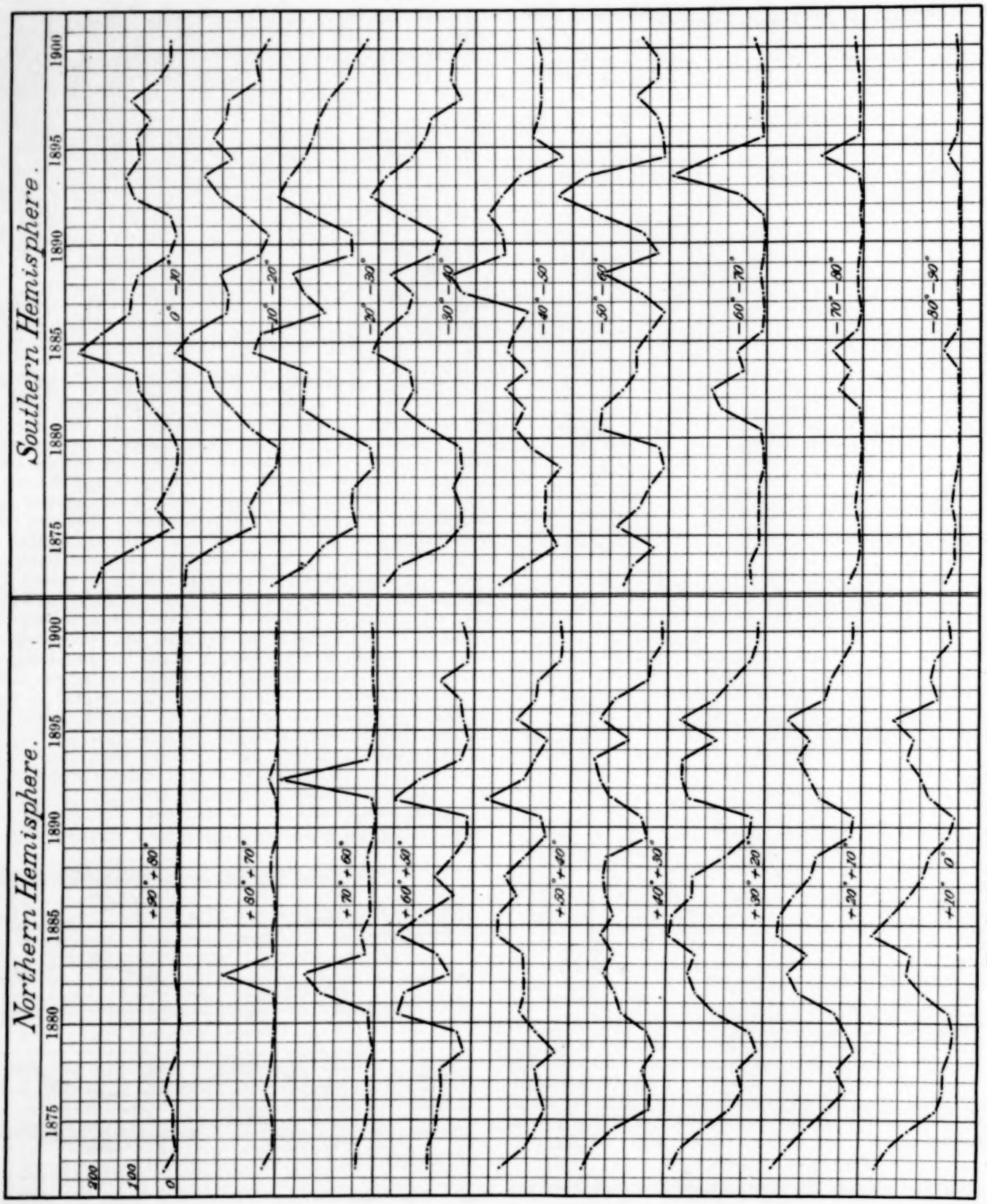


FIG. 2.—Observed variation of the relative frequency of the solar prominences in 10-degree zones.

shape, or at least affording freer egress for the escaping products of compression along one axis. This phenomenon is best seen at times of minimum activity, because near the maximum the output so far increases in vigor as to be distributed more equally in all longitudes, and to conceal this special tendency to concentrate along a given axis.

An entirely similar result was obtained in my discussion of the solar spots by taking an ephemeris based upon the period of the rotation at the equator, that is, 26.68 days (synodic). Compare Bulletin No. 21, Solar and Terrestrial Magnetism, Weather Bureau, 1898, page 141, or Bulletin I, Eclipse Meteorology, page, 91. The compilation of the deflecting vectors of the terrestrial magnetic force gives a curve of the same type as do the primary and secondary variations.

An inspection of the groups of spot numbers in the tables in which the data were collected does not indicate any tendency to drift to the right or left as one passes through the great 11-year cycles, and this shows that the spots have sufficiently short lives relatively to this period to be subordinate to the primary source of the output from the solar nucleus, which latter must have some properties independent of the observed surface phenomena themselves. The angular velocity of surface drift varies in latitude, but the internal action that produces spots appears to be united closely with the observed period at the equator itself, and there is also reason to believe that the period at the equator is the same as that at the poles. The equatorial plane may be assumed to rotate with the same velocity as the interior mass and to have the true period of rotation. The observations indicate that there is a structure which produces an excess of output on certain meridians about 180° apart. This is the result of our discussion of the distribution of the solar activity in longitude, and we will now proceed to consider the evidence that there is a structural distribution of energy in latitude.

DISTRIBUTION IN LATITUDE.

The Italian observations of the solar prominences made by Secchi, Tacchini, and Ricco, from the year 1871 up to the present time, published in the Memorie della Societá degli Spettroscopisti Italiani, constitute a valuable series of data as homogeneous in character as it is possible to produce. A shorter series by Rev. J. Fenyi, S. J., at the Haynald Observatory, Kalocsa, has been published for the years 1884 to 1890, inclusive, and additional volumes of this important work are in preparation. Sir Norman Lockyer has recently published in volume 70 of the Proceedings of the Royal Society some conclusions derived from the Italian data, but I have for myself collected together the frequency numbers for the sake of their bearing upon the problem of the circulation of the mass of the sun which is about to be described. Lockyer's curve and my own agree in showing the same variation of the annual frequency numbers for the years 1871 to 1900, inclusive. My compilation has been extended to include the solar spots and faculæ for the interval 1880 to 1900. For the years 1872–1877, Secchi collected his data by periods of solar rotation, using the period 27.78 days; for the years 1878–1900 Tacchini and Ricco have collected the data by the calendar months. I have reduced the Secchi series to the year intervals, in order to make the annual numbers homogeneous with the Tacchini series. The number of observations of the prominences, spots, and faculæ has been distributed into 10-degree zones in latitude from the north pole to the south pole of the sun for each rotation and month, respectively, of the two series, that is, 90° to 80°, 80° to 70°, ... —70° to —80°, —80° to —90°. The sums are taken by zones, and also by rotations or months, and are checked by producing the same annual sum. The annual numbers of prominences, spots, and faculæ, respectively, were plotted on diagrams in order to exhibit the changes going on in the sun during the three past 11-year cycles, but these charts and the expanded tables are not reproduced in this present paper.

It was concluded, as the result of a careful examination of the charts, that the average variation of the output could be most satisfactorily reduced to a law by combining these three cycles together, and thus eliminating to some extent two sources of irregularity, (1) that due to the spasmodic action of the sun, and (2) that caused by the difference of cloudiness from season to season in Italy, which modified the number of days available for the observations. The numbers are collected in groups of three years each, beginning 1872, 1883, 1894, as shown in Tables 1 and 2. The years which correspond with each other in the 11-year cycle are placed together, and it makes no difference where the mean cycle begins to be numbered. By passing down the table from 1872, three times in succession, the annual numbers are found, and can be used in other discussions. The data are now exhibited in several ways. On fig. 2 is given the variations found by plotting the annual numbers in each 10-degree zone in succession for the years 1872–1901. Thus, in the 90° to 80° zone of the northern hemisphere we have from Table 1 the numbers 35, 3, 9, 10, ... which give the first broken line of the chart. Viewing this chart as a whole we make the following notes: (1) The 11-year cycle variation is strongly developed in the equatorial zones and diminishes in intensity toward the polar zones, where it has nearly disappeared. (2) By plotting the mean annual numbers only the prominence variation line is produced; see the first curve of fig. 28, in my article No. VII, "A contribution to cosmical meteorology," published in the MONTHLY WEATHER REVIEW for July, 1902. (3) Although there is considerable variation in the amplitude of the same annual frequency number, that is, in the series of crests formed during the same year in different zones, it is evident that the sun is affected throughout its photosphere by the increase and decrease of the output of energy as registered in the prominence numbers. (4) The irregularity, however, is so large as to show that the sun acts like a congested and discharging viscous mass, through a series of distortions, accelerations, and retardations, in different parts of its mass, and that it does not transfer its internal energy into outside work uniformly and symmetrically. It is extremely important to remember this because in discussing the data for the period of the solar rotation, *we do not have a series of independent events to combine*, as the theory of least squares or the law of errors demands. It is preferable to work out the period by methods more practical than the application of the Fourier series and the Schuster periodogram, which depend upon the occurrence of independent events, and an expectancy based upon the law of errors. The sun does not exhibit a steady potential system of either electric or magnetic forces, nor any steady recurrence of events upon its surface which can be combined by rigid analytic laws. This is a natural consequence of the fact that the mass of the sun fills an immense volume in space and is experiencing congestion and escape of heat energy generated by gravitational compression. It is, furthermore, necessary to free the solar data from terrestrial meteorological effects before any type of least square analysis can be properly applied. To emphasize this point more fully, Tables 3, 4, and 5, derived from the original tabulation, give the sums for each rotation or month, respectively, for the entire solar surface, by summing up the numbers found in the several zones. It is seen that in the monthly means of the prominences there is a very distinct annual variation in the number of prominences observed. This can be due only to the annual change in the Italian climatic conditions which affected the making of the observations, and it shows that the recorded frequency numbers are not free from a strong terrestrial term which must modify all discussions in solar physics, unless satisfactorily eliminated. The tables for the solar faculæ show the same seasonal variation as the prominences, but less con-

TABLE 1.—*Mean observed distribution in latitude during the 11-year solar cycle. Solar prominences.*

Years.	90° 80	80° 70	70° 60	60° 50	50° 40	40° 30	30° 20	20° 10	10° 0	0° −10	−10° −20	−20° −30	−30° −40	−40° −50	−50° −60	−60° −70	−70° −80	−80° −90	Annual sums.
(1)																			
1872	35	39	47	106	164	218	229	225	207	216	246	270	234	184	120	33	34	38	2,645
1883	9	10	22	97	116	141	172	138	125	121	187	193	169	112	88	56	32	8	1,796
1894	2	1	9	15	58	99	125	136	116	111	123	196	161	30	14	130	106	35	1,467
Mean	15	17	26	73	113	153	175	166	149	149	185	220	188	109	74	73	57	27	1,969
(2)																			
1873	3	10	38	107	107	181	206	165	175	201	235	182	188	106	92	40	7	10	2,053
1884	3	11	42	195	191	165	245	213	217	263	266	322	265	164	91	72	83	48	2,856
1895	0	1	4	29	131	169	212	194	166	124	171	167	135	101	20	3	7	6	1,640
Mean	2	7	28	110	143	172	221	191	186	196	224	224	196	124	68	38	32	21	2,183
(3)																			
1874	9	5	24	94	84	130	150	141	125	116	161	138	82	93	44	10	2	7	1,415
1885	3	3	17	139	181	139	229	208	175	201	232	299	242	148	48	6	12	2	2,284
1896	6	3	4	37	93	141	131	100	53	89	147	151	117	92	28	9	7	3	1,211
Mean	6	4	15	90	119	137	170	150	118	135	180	196	147	111	40	8	7	4	1,637
(4)																			
1875	10	13	15	87	60	46	78	81	55	26	61	52	44	61	137	19	5	6	856
1886	1	9	18	48	132	152	180	172	130	141	146	139	174	116	16	4	5	2	1,585
1897	4	6	8	90	81	52	91	85	74	138	139	126	41	76	80	11	6	5	1,113
Mean	5	9	10	75	91	83	116	113	86	102	115	106	86	84	78	11	5	4	1,185
(5)																			
1876	40	29	19	76	75	39	50	43	41	66	84	65	44	66	77	19	20	23	876
1887	12	15	15	99	162	161	178	136	96	134	140	192	156	287	70	9	12	3	1,877
1898	5	9	12	17	26	47	39	52	59	62	102	89	61	79	29	13	11	9	721
Mean	19	18	15	64	88	82	89	77	65	87	109	115	87	144	59	14	14	12	1,158
(6)																			
1877	25	18	17	33	78	53	62	57	39	43	52	60	54	64	50	13	13	11	742
1888	8	16	25	49	117	152	99	116	75	110	155	216	220	317	176	16	15	5	1,887
1899	5	10	11	16	23	13	17	24	24	31	56	57	54	82	31	17	21	6	498
Mean	13	15	18	33	73	73	59	66	46	61	88	111	109	154	86	15	16	7	1,042
(7)																			
1878	1	7	3	19	34	34	13	16	17	12	9	8	35	31	8	1	3	1	252
1889	2	2	6	21	62	51	36	32	30	38	52	65	104	174	39	6	4	0	724
1900	5	9	16	36	30	18	19	25	27	35	31	32	31	96	68	31	24	10	543
Mean	3	6	8	25	42	34	23	24	25	28	31	35	57	100	38	13	10	4	506
(8)																			
1879	1	5	13	46	85	49	33	29	10	9	4	24	45	101	27	5	3	1	490
1890	3	1	0	19	75	66	29	22	11	15	30	69	96	185	61	1	0	2	685
Mean	2	3	7	33	80	58	31	26	11	12	17	47	71	143	44	3	2	2	588
(9)																			
1880	0	4	21	187	128	110	121	63	26	37	70	110	119	148	177	14	2	1	1,338
1891	3	5	16	199	215	146	182	107	69	34	91	160	183	220	178	17	7	4	1,836
Mean	2	5	19	193	172	128	152	85	48	36	81	135	151	184	178	16	5	3	1,587
(10)																			
1881	5	13	143	169	107	132	175	153	93	76	126	197	191	116	170	115	15	2	1,998
1892	0	23	247	137	119	172	207	136	98	124	154	252	272	183	283	62	2	1	2,472
Mean	3	18	195	153	113	152	191	145	96	100	140	225	232	150	227	89	9	2	2,235
(11)																			
1882	21	146	177	56	108	160	196	193	133	114	168	198	157	172	118	141	63	6	2,327
1893	0	10	25	29	93	187	206	158	132	149	195	229	226	138	208	242	13	1	2,241
Mean	11	128	101	43	101	174	201	176	133	132	182	214	192	155	163	192	38	4	2,284

spicuously developed, while the sun-spot means are practically unaffected by the climatic changes. This difference must be attributed to the relative length or duration of the three phenomena, the spots having a life sufficiently long to bridge over the gaps covered by cloudy weather in Italy, so that the true number of spots which occur on the sun is really counted. This is true of the faculæ to a lesser degree because their lives are shorter than the sun spots, and some come and go in the intervals of stormy weather without being enumerated at all. The prominence numbers especially are subject to loss by not being observed continuously, because their life is usually very brief, so that the prominences which occur in successive meridian areas and are seen only on the edge of the sun can not be fully counted under ordinary observing conditions. The Kalocsa observations exhibit similar disturbances due to the conditions. If the observations of 1884–1890 be collected in a similar manner to that adopted above, we find that the numbers increase decidedly from 1884, which is a maximum year, to 1890 which is a minimum year, and this is contrary to the probable course of the events. The Italian observations decrease from 1884 to 1890, and the two series are opposite to each other in this respect, though they give similar zonal distributions so far as the maxima are concerned. Steadiness in observing and elimination of cloudy weather was therefore indispensable in order to procure reliable data for these discussions in solar physics. So far from being independent almost all solar data are mutually dependent upon adjacent events, and Professor Schuster's method of the periodogram is subject to this sort of limita-

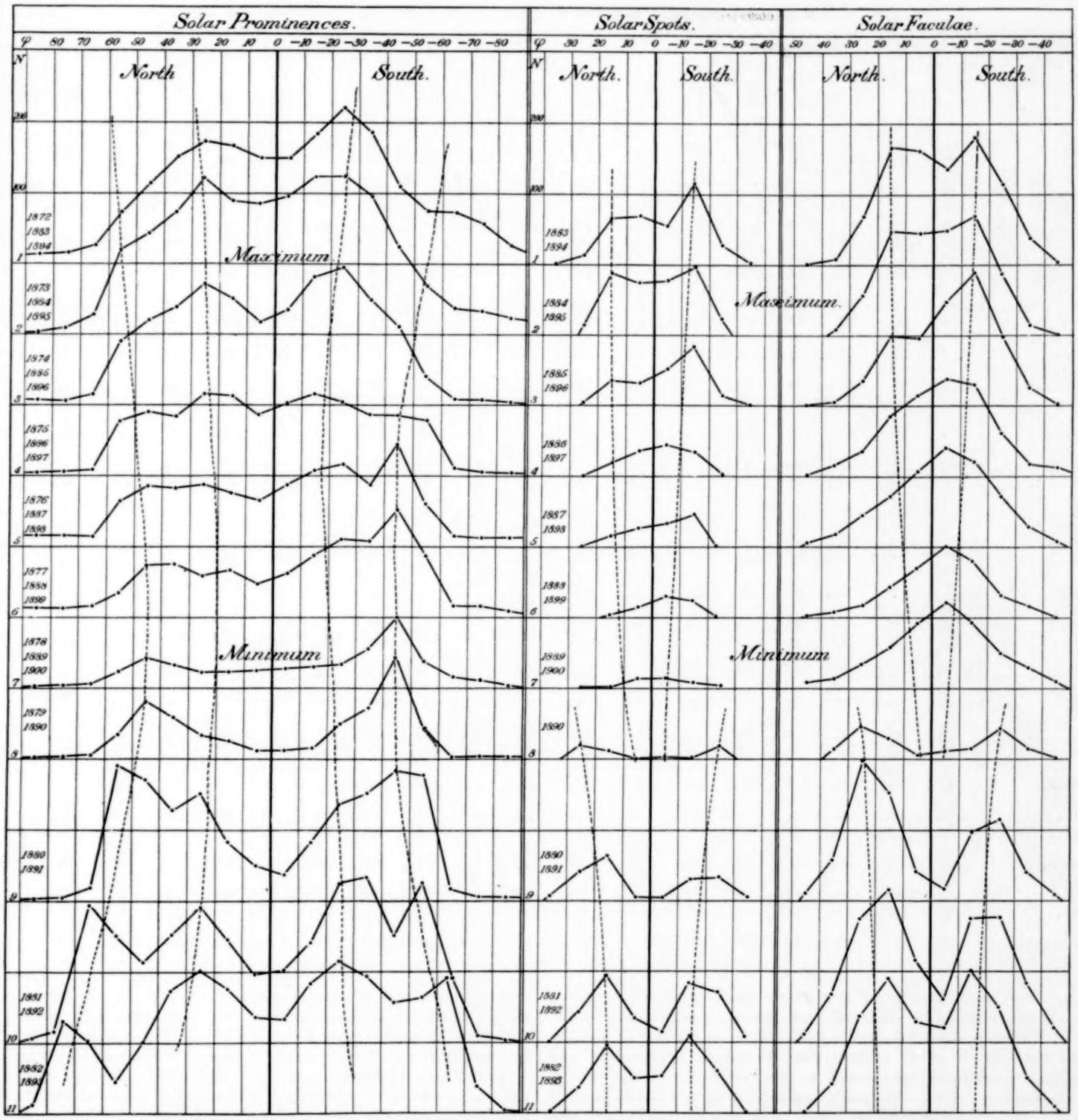


FIG. 3.—Mean variation of the distribution in latitude during the 11-year periods of the interval 1872–1900.

TABLE 2.—*Mean observed distribution in latitude during the 11-year solar cycle. Solar spots and faculæ.*

Years.	SOLAR SPOTS.									SOLAR FACULÆ.									
	40° 30	30° 20	20° 10	10° 0	0° −10	−10° −20	−20° −30	−30° −40	Annual sums.	Above 40°	40° 30	30° 20	20° 10	10° 0	0° 10	−10° −20	−20° −30	−30° −40	Below −40°	Annual sums.
(1)																				
1883	1	7	57	63	58	107	20	.....	313	.....	7	68	175	154	117	159	89	24	.....	793
1894	1	21	71	73	56	129	33	3	387	1	6	64	152	166	154	199	139	53	7	941
Mean	1	14	64	68	57	118	27	2	350	1	7	66	164	160	136	179	114	39	4	867
(2)																				
1884	.....	11	92	85	109	113	22	.....	432	.....	4	44	135	143	174	168	69	11	.....	748
1895	.....	19	85	61	44	82	24	.....	315	.....	9	69	161	145	121	167	104	14	1	791
Mean	.....	15	89	73	77	98	23	.....	374	.....	7	57	148	144	148	168	87	13	1	770
(3)																				
1885	.....	3	32	38	75	80	6	2	236	1	2	20	97	99	164	169	40	2	.....	594
1896	.....	2	41	28	29	89	19	.....	208	.....	7	55	100	96	129	209	156	45	5	802
Mean	.....	3	37	33	52	85	13	1	222	1	5	38	99	98	147	189	98	24	3	698
(4)																				
1886	.....	1	21	17	32	25	2	.....	98	.....	4	8	39	47	70	63	23	3	1	258
1897	.....	.....	17	52	58	42	2	.....	171	3	25	62	129	181	207	197	96	27	19	946
Mean	.....	1	19	35	45	34	2	.....	135	2	15	35	84	114	139	130	60	15	10	602
(5)																				
1887	.....	1	10	10	30	20	.....	.....	71	1	5	9	21	32	53	39	7	1	1	169
1898	.....	.....	23	45	38	74	.....	.....	180	6	32	76	122	181	226	200	133	53	15	1,044
Mean	.....	1	17	28	34	47	.....	.....	126	4	19	43	72	107	140	120	70	27	8	607
(6)																				
1888	.....	.....	3	14	35	10	.....	.....	62	.....	1	2	9	37	71	38	2	.....	.....	160
1899	.....	.....	6	15	25	40	.....	.....	86	8	15	36	75	103	130	118	62	33	2	582
Mean	.....	.....	5	15	30	25	.....	.....	74	4	8	19	42	70	101	78	32	17	1	371
(7)																				
1889	.....	3	0	5	15	3	8	.....	34	1	2	6	6	15	30	19	12	2	1	94
1900	.....	.....	4	21	18	14	.....	.....	57	15	28	65	112	171	211	168	90	57	20	937
Mean	.....	2	2	13	17	9	4	.....	46	8	15	36	59	93	121	94	51	30	11	516
(8)																				
1890	.....	20	13	1	3	3	21	.....	61	.....	15	45	31	6	11	16	44	14	1	183
(9)																				
1880	6	24	45	8	7	33	32	3	158	19	85	244	150	45	21	124	146	60	14	908
1891	.....	57	85	6	1	27	33	6	215	1	33	152	155	37	12	71	83	19	1	554
Mean	6	41	65	7	4	30	33	5	187	10	59	198	153	41	17	98	115	40	8	731
(10)																				
1881	.....	52	93	22	12	79	61	.....	319	15	109	253	279	121	58	195	187	92	32	1,341
1892	2	34	93	44	16	89	78	12	368	4	27	100	156	112	61	152	167	72	11	862
Mean	1	43	93	33	14	84	70	6	344	10	68	177	218	117	60	174	177	82	22	1,102
(11)																				
1882	.....	35	80	38	37	68	40	.....	298	3	50	161	188	107	85	163	120	37	9	923
1893	1	39	115	55	67	148	79	6	510	3	29	110	189	148	154	238	173	57	6	1,107
Mean	1	37	98	47	52	108	60	3	404	3	40	136	189	128	120	201	147	47	8	1,015

tion. The same is true of almost all the terrestrial meteorological elements, and generally a negative result which is derived from the discussion of a periodic or cyclic curve is valuable only when it is certain that the data conform to the analytic presuppositions, such as are laid down in the theory of the energy curve. Schuster applied his theory to the Greenwich magnetic declinations taken from day to day, where the hourly variation is eliminated. It can be shown that the declination is a component which vanishes in theory, and exists in practise only as a measure of the feeble variations of the earth's field which are distinctly accidental and only remotely connected with the solar action.

VARIATIONS IN LATITUDE IN THE 11-YEAR CYCLE.

We will now consider the prominences, spots, and faculæ in the 11-year cycle in order to discover whether there is some evidence of a periodic variation in the latitude at which the output from the interior of the solar mass becomes visible to us. An inspection of the details of the three cycles contained within the interval of time 1872–1900, shows that there is a triple repetition of similar variations in these elements, and suggests that the mean values of the years similarly placed in the 11-year period may be taken as a close approach to the law underlying these cyclical changes. The means of Tables 1 and 2 are plotted on fig. 3. The scale denotes the frequency numbers as counted from the Italian observations, and the zones are indicated by the degrees at the top of the chart. Dotted lines are drawn through the systems of the maximum numbers to mark the difference in latitude at which these develop. The prominences have two distinct maxima, generally, throughout the period, except that the one in high latitudes, 60°–70°, nearly disappears at the time of maximum spot frequency and the one in low latitudes, 20°–30°, practically disappears at the time of the minimum number of spots. After the minimum which has crests in high latitudes there is a vigorous recrudescence of the prominences in two distinct belts of maxima, 20°–30° and 40°–50°, with a tendency to diverge toward lower and higher latitudes; the higher varies 25° in latitude and the lower less than 10°. This swing in latitude of the maximum points is accompanied by a decided

TABLE 3.—*Italian observations. Observed mean monthly distribution of the solar prominences.*

Rotation.	1872.	1873.	1874.	1875.	1876.	1877.	Mean.
1	202	150	91	37	13	40	89
2	229	200	135	69	51	75	127
3	214	130	140	60	51	59	109
4	157	188	93	55	26	37	93
5	219	180	97	65	51	55	111
6	229	139	107	45	42	95	110
7	281	215	96	48	47	54	124
8	315	229	105	124	107	115	166
9	287	105	111	131	114	82	138
10	143	190	163	51	105	42	116
11	129	89	75	71	83	31	80
12	130	98	115	46	88	54	89
13	110	140	35	54	59	3	67
14	.....	.....	52	.....	39	.....	.....

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
January	3	7	13	45	229	95	139	104	116	115	198	76
February	26	4	71	80	242	137	186	197	98	134	107	84
March	39	7	145	88	184	97	317	146	126	137	197	140
April	33	.....	54	109	146	133	212	111	82	129	266	49
May	31	12	81	210	183	183	237	226	162	127	181	19
June	27	64	146	177	269	122	237	351	174	257	117	20
July	59	57	260	299	288	219	364	328	233	268	154	62
August	22	61	137	284	249	167	399	221	162	231	222	99
September	.....	80	137	187	169	133	233	177	149	161	144	75
October	4	100	120	121	137	233	269	104	68	69	158	29
November	8	58	77	258	139	135	152	126	138	141	73	47
December	.....	40	97	140	92	142	111	193	77	108	70	24

Month.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	Mean.
January	25	60	83	145	87	28	134	60	53	45	40	83
February	27	170	95	214	141	69	155	69	42	38	13	104
March	29	110	122	272	159	127	71	109	31	40	20	118
April	38	138	158	324	104	131	77	85	60	45	32	109
May	31	98	207	143	114	141	103	84	26	18	48	116
June	63	108	330	161	178	181	125	119	77	51	36	147
July	60	256	323	167	157	257	143	81	64	52	68	183
August	82	210	296	267	167	246	105	113	78	44	56	170
September	68	220	305	185	116	178	106	143	121	76	96	142
October	175	217	186	138	78	93	102	101	86	42	60	117
November	36	98	216	70	104	114	55	95	27	28	20	96
December	51	151	151	155	62	75	35	54	56	19	54	85

TABLE 4.—*Observed mean monthly distribution of the solar spots.*

Month.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
January	15	20	28	29	56	26	8	6	7	.....	3
February	5	19	27	19	32	37	9	7	5	4	1
March	9	19	32	14	43	16	18	6	4	4	2
April	6	38	27	32	35	19	14	5	8	1	6
May	9	34	24	23	37	23	8	8	2	1	6
June	10	25	16	26	28	28	11	8	3	1	4
July	13	54	27	22	42	18	9	11	5	7	4
August	18	14	17	29	44	20	5	3	10	4	6
September	24	22	22	22	37	13	8	6	10	2	13
October	24	25	30	35	32	15	2	4	1	3	8
November	14	26	28	28	23	14	1	2	4	.....	3
December	11	23	20	34	23	7	5	5	3	7	5

TABLE 4.—*Observed mean monthly distribution of the solar spots*—Continued.

Month.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	Means.
January	8	34	33	36	36	19	19	12	12	5	20
February	11	21	23	27	19	20	11	18	7	5	16
March	9	25	36	34	26	25	19	14	6	4	17
April	18	29	60	24	36	20	22	14	11	10	21
May	17	29	41	37	22	16	11	12	2	7	18
June	21	36	39	35	29	13	4	21	7	6	18
July	29	33	49	38	24	21	15	11	9	6	21
August	20	28	66	38	28	11	10	10	2	2	18
September	23	29	49	41	30	23	23	13	6	7	20
October	22	44	49	19	24	16	19	29	11	3	20
November	17	25	32	34	15	11	5	17	5	2	15
December	20	35	33	24	26	13	13	9	8	.....	15

TABLE 5.—*Observed mean monthly distribution of the solar facular.*

Month.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
January	34	52	64	60	81	57	18	12	17	1	21
February	53	59	81	54	73	82	16	16	7	1	12
March	109	87	92	45	74	64	30	20	17	4	13
April	29	123	76	57	61	42	25	9	14	4	7
May	47	150	80	61	50	58	40	15	8	6	15
June	57	128	79	56	67	63	40	24	12	7	12
July	74	181	116	39	68	41	32	15	14	12	14
August	81	141	80	58	64	46	13	14	18	24	17
September	136	161	64	92	66	56	18	9	24	12	27
October	115	102	50	101	47	22	9	7	8	11	12
November	86	85	62	86	50	31	5	12	9	2	16
December	87	72	79	84	47	32	12	16	12	10	17

Month.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	Means.
January	8	52	68	79	54	56	63	83	34	73	47
February	37	42	76	76	38	61	60	67	70	45	49
March	30	56	87	53	70	68	65	78	31	71	55
April	43	71	91	57	88	89	83	62	39	76	55
May	52	75	119	68	49	75	69	132	48	52	60
June	63	97	107	103	87	62	89	94	56	95	67
July	75	94	125	88	90	83	91	132	83	68	73
August	64	59	94	86	68	82	116	138	98	146	72
September	46	84	85	86	66	68	68	97	12	97	65
October	51	92	78	74	60	66	72	57	14	76	54
November	37	65	65	96	75	40	95	45	51	38	50
December	48	75	112	75	46	52	75	59	46	100	55

variation in the number observed, as indicated by the change in the areas included between the lines of prominence numbers and the axis of abscissas. The spots and the faculæ have each only one maximum in the same hemisphere, which gradually approaches the equator from about latitude 25° at the time of recrudescence just following the maximum number. The dying spots of an old cycle in low latitudes very near the equator occur while a new series of spots is appearing in the higher latitudes. Fig. 3 tells its story so clearly that it is not necessary to describe it in greater detail.

We can bring out its meaning, however, in connection with the probable internal circulation from the interior of the sun more distinctly by constructing the movement of the maximum point of relative frequency in latitude during an 11-year cycle of the solar prominences, spots, and faculæ, see fig. 4. The point on fig. 3 where the dotted maximum line crosses the line of relative frequency fixes the latitude of the maximum number. Hence, we take for coordinates the number from the scale of ordinates and the latitude from the abscissas (N, φ) and transfer these coordinates in succession from year to year to fig. 4. The first point in the prominence curve in the northern solar hemisphere is for the year 1894 ($N = 64$, $\varphi = 57°$), and this is plotted at latitude 57° at the same scale distance from the solar disk, as on fig. 3 from the axis of abscissas, and marked 94, meaning the year 1894. The successive points mark the locus of the movement of this maximum in the 11-year cycle. The same method is applied to the two prominence systems of maxima in each hemisphere, and to the single maximum of spots and faculæ in each hemisphere, respectively, the latter being plotted on the left-hand side of fig. 4 in order not to confuse the drawing. The diagram is to be interpreted as representing the variations of the maximum solar output in belts or zones extending around the entire photosphere.

It is instructive to note the regular course that this variation pursues, and this is of fundamental importance as indicating some characteristic conditions of the solar circulation. Beginning with the minimum years 1889 and 1890, the polar group of prominences rises rapidly until 1891, turns quickly toward the pole until 1893, then diminishes the number and gradually completes the circuit, with slow decrease of latitude, to 1899. The southern polar group maximum traces quite the same circuit, which has a considerable area and a peculiar lip at the years of minimum frequency. The equatorial prominence group begins in latitude 22°, rises quickly to a maximum height in the same latitude, lingers nearly in the same position

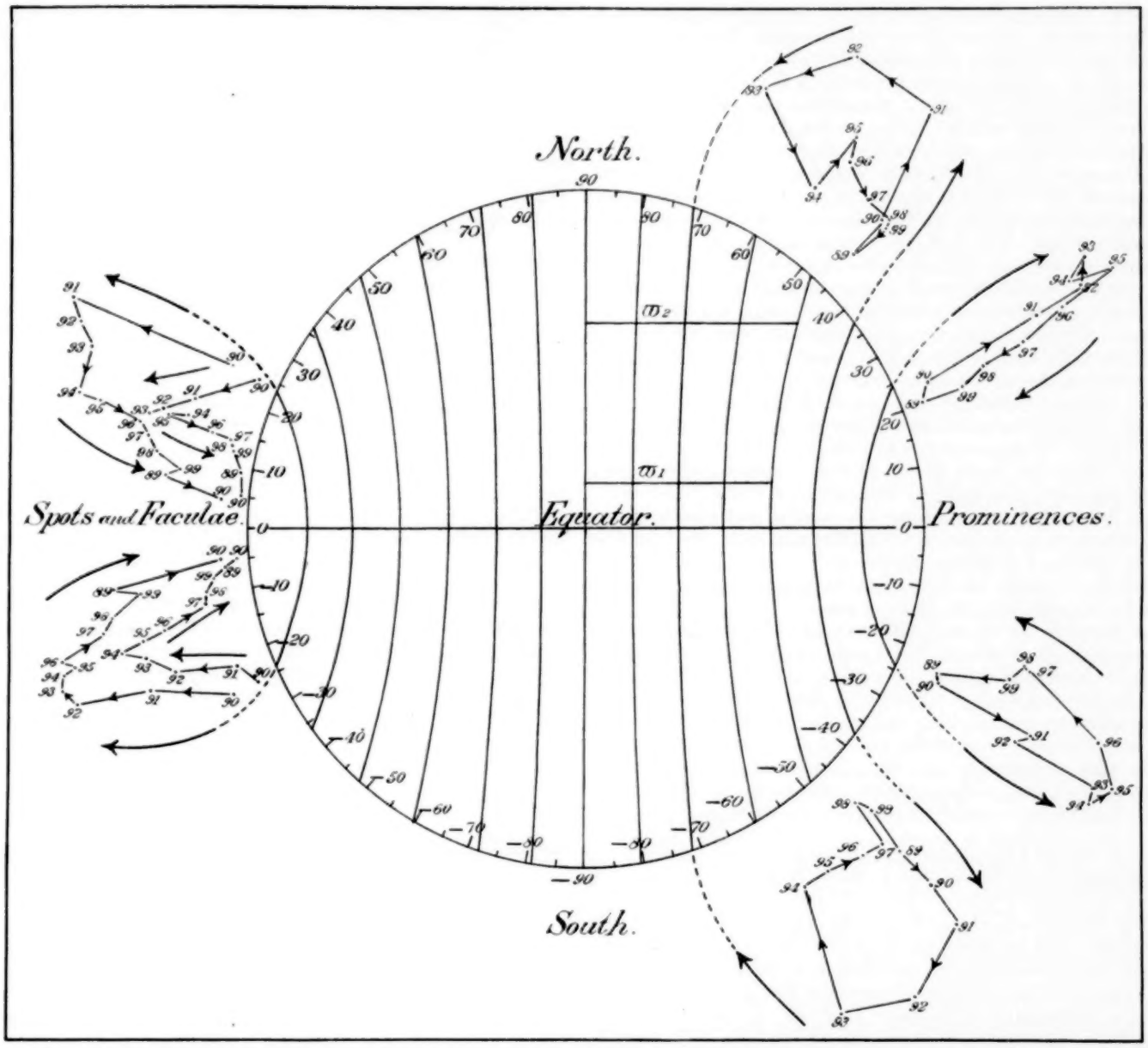


FIG. 4.—Movement of the maximum point of relative frequency in latitude during an 11-year cycle of the solar prominences, spots, and faculæ.

for several years (1893–1895), with small decrease in latitude, and is followed by a gradual return to the beginning of the circuit. The same remarks hold true for both hemispheres. The equatorial area is long and narrow and the polar approximately equilateral in form, showing that the former changes less in latitude than the latter, the height being about the same in each case. I have drawn some large arrows to show that a general movement outward is indicated for latitudes 22° to 45° at the recrudescence of the prominences, and that there is a movement inward in the equatorial and in the polar latitudes.

A similar construction for the faculæ shows that after the minimum they also spring up powerfully to their greatest frequency in latitude 25°, and that they decline gradually with diminution of the latitude till they reach a minimum, where the characteristic double-belt occurrence takes effect. The spots construct a triangular area, well within that covered by the faculæ, and they increase more slowly and decline more regularly than do the faculæ, while the latitude is diminishing. The heavy arrows drawn on fig. 4 indicate an outward impulse in the middle solar latitudes and an inward movement nearer the equator. This result is in perfect harmony with that obtained for the prominences, and we can not avoid the conclusion that the sun in cooling emits energy and discharges material more vigorously in the middle latitudes than in the polar and the equatorial regions. This suggests the primary conditions of the circulation which prevail for a large mass like the sun cooling by discharge of matter and by radiation.

Care should be taken not to misinterpret the long arrows which have been placed upon fig. 4. These represent the direction of the rising of the maximum points to their highest positions and then the sinking back toward the surface. As shown by fig. 3 the entire solar surface is emitting outward, even when the arrow is pointing inward. Nevertheless, the movements of the maximum points in latitude and altitude must be attributed to an excessive output of energy, and this points to a fundamental circulation of the heat energy and of the material substances in the sun. The next problem in solar physics is to discover the laws that control this special variation of the distribution of energy.

It is proper in this connection to reproduce the lines of the Helmholtz–Emden thermal structure, already noted in Bulletin I, Eclipse Meteorology and Allied Problems, p. 71. The in-

terior curves computed from Helmholtz's equations harmonize so happily with the exterior lines derived from this discussion on the output of the sun, that the probability is strengthened that this scheme is the proper one with which to enter upon the analysis of the internal circulation of the sun. As already noted in that bulletin, if the vortex law ($\omega\varpi^2 =$ constant, where $\varpi =$ the radius and $\omega =$ the angular velocity) holds good in this case, then we have an explanation of the cause of retardation of the diurnal angular velocity of the motions of the photosphere in middle latitudes as referred to the equatorial or polar belts. For if $\varpi_2 > \varpi_1$ then $\omega_2 < \omega_1$, and since ω_1 is the initial rotational velocity at the equator, the angular velocity in middle latitudes must be less than at the equator or at the poles. This agrees with the result of the surface observations. Furthermore, the equatorial angular velocity is probably that of the interior mass, or nucleus of the sun, and the poles should have the same velocity, a result in harmony with that deduced from my discussion of the terrestrial magnetic field. This equatorial and polar angular velocity gives a 26.68-day synodic period for the rotation of the sun. Finally, the middle latitudes must give a slower angular velocity and a greater period, such as 27.30 days in the belts 12° to 15°. Since the mass of the sun ought not by this theorem to have in any portion of it an angular velocity less than that of the equatorial plane, it does not appear to be reasonable that the short periods of about 25.80 to 26.00 days, which several investigators have announced as that of the sun's rotation derived from a discussion of several different terrestrial phenomena, can be correct. It is very difficult to perceive how there can be any basis for a period shorter than 26.68 days; on the contrary these authors seem to find a period at least one day shorter than the quickest period that can be derived from the observations and discussions of surface solar phenomena. It is very probable that the problem of the circulation within the sun must be worked out before we can hope to bring that of the rotation of the solar mass to a satisfactory understanding.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the weather was about normal, but for a slight excess of heat and the extreme dryness of the atmosphere, as can be seen from the observations at San José. On the Atlantic slope rain was generally scarce.

Notes on earthquakes.—January 1, $0^h\ 45^m$ a. m., protracted shaking E–W, intensity IV, duration 28 seconds. January 2, $1^h\ 49^m$ a. m., tremors. January 3, $5^h\ 32^m$ a. m., slight shock E–W, intensity II, duration 5 seconds. January 3, $10^h\ 39^m$ p. m., tremors. January 13, $8^h\ 12^m\ 46^s$ p. m., strong shock N–S, intensity III, duration 3 seconds.

HIGH WINDS IN MOUNTAIN VALLEYS.

By ALTON D. ELMER, Northfield, Mass., dated February 10, 1903.

I inclose a newspaper clipping relative to the storm of January 31, 1903, which may interest you, as it is illustrative of a phenomenon which is a part of every extra high wind from west or northwest in the Green Mountain passes. The pressure on the west side of the Appalachians seems to break through the cuts like water, with disastrous results to the towns in the valleys facing them. The towns at the mouths of the passes (Readsboro and Wilmington, Vt., being examples) of course suffer the most. I only send you one cutting, relating to a sample valley town, not in the mouth of a pass.

HIGH WIND AT ZOAR, MASS.

W. D. Rifenburg, who has charge of the wrecking crew, is authority for the following story: He says that when the west bound freight, 205, was passing through Zoar, Saturday, the wind struck an empty box car with tremendous force and lifted it bodily from the trucks and tipped it over on the east bound track. The portion of the car was jacked up, and again the wind struck and tipped it over. When the wreck was cleared the men waited in the station, when the wind struck it with such force that the men thought the station would blow down and left it. All the men say they never encountered such a terrific wind in their lives.

Reports from all such valley towns would fill a scrapbook. This phenomenon should not be compared with that of the easterly winds (see MONTHLY WEATHER REVIEW, 1897, Vol. XXV, pp. 212, 307; 1898, Vol. XXVI, p. 66), inasmuch as the east and southeast gales seem to attain their destructive force in the valleys at the leeward bases of mountain ranges.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table in advance of the regular monthly weather report for Jamaica:

Comparative table of rainfall for January, 1903.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			Average.	1903.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	21	5.38	3.00
Northern division	22	47	3.38	1.99
West-central division	26	21	2.19	1.73
Southern division	27	32	1.70	1.03
	100	121	3.16	1.94

The rainfall for January was therefore much below the average for the whole island. The greatest rainfall, 8.82 inches, occurred at Port Antonio, in the northeastern division, while at Fort Hill in the southern division 0.05 of an inch fell.

Comparative table of rainfall for December, 1902.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			Average.	1902.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	21	9.91	14.82
Northern division	22	47	5.72	11.60
West-central division	26	21	3.78	4.07
Southern division	27	32	2.66	2.45
	100	121	5.52	8.23

The rainfall for the whole island was, therefore, considerably above the average. The heaviest fall recorded was, 47.94 inches, at Moore Town, in the northeastern division, while 0.32 of an inch fell at New Yarmouth in the southern division.

THE SOUTHERN LIMIT OF A NORTHWEST GALE.

By H. H. TENBROECK, of Braidentown, Fla.

On the morning of September 9, 1902, there was an instance of the meeting and arresting of a northwest gale in the neighborhood of Braidentown, Fla.

At sunrise there was a bank of very dark clouds in the northwest that rose slowly and showed the rolling overhanging mass that characterizes such clouds. The wind was fresh from the southeast, the sky was generally covered with very threatening, dense cumulus clouds. By 8 a. m. the bank in the northwest had risen about 15° or 20° with every indication of a squall of wind and rain immediately. But the bank began to grow lighter, the overhanging rolling mass disappeared and the whole broke up into a mass of ill-defined cumulus clouds, the wind increasing in force from the southeast and the clouds becoming more dense and threatening. By noon, however, the wind lessened in force, the clouds became thinner and more scattered, and the bank in the northwest entirely disappeared. Twice before I have noted the same phenomenon of a northwest gale reaching its limit.

Thinking that a note of this occurrence might add a grain of information about the very interesting matter of air currents, I send it to you.

INDUCTIVE STUDIES IN WEATHER INFLUENCE.[1]

By Prof. EDWIN G. DEXTER, dated the University of Illinois, Urbana, February 2, 1903.

It is my purpose in this paper to outline briefly and state some of the more general conclusions to be drawn from a series of studies which I have made of the influence of definite meteorological conditions upon human conduct. No one who has been at all observant of his own subjective states can doubt that they vary with changes in the weather. Weather proverbs presuppose some direct influence of meteorological conditions upon the lower animals, and literature is full of allusions to similar influences upon man. It was for the purpose of determining this influence, both qualitatively and quantitatively, that my studies were undertaken.

The method followed is a purely inductive one and consists of a comparison of the average daily occurrence of certain recorded abnormalities of conduct, with their occurrence under definite meteorological conditions. The data of conduct considered by me were all taken from the records of New York City, viz, those of the coroner, chief of police, and superintendent of schools, and consisted of the daily record of suicides, both successful and attempted, of arrests for assault and battery and drunkenness, and of deportment in the city penitentiary and certain of the public schools, in all nearly 500,000 separate occurrences covering a period of ten years. The meteorological data for comparison were taken from the records of the New York station of the United States Weather Bureau and comprise the mean temperature, barometer, and relative humidity, the total movement of the wind, the character of day, and the precipitation for each day of the period covered by the data of conduct.

The latter were as follows, with the sources of each class:[2]

1. Registration in public schools, 118,020 school records.
2. Deportment in public schools, 14,020 school records.
3. Deportment in penitentiary, 3981 penitentiary records.
4. Arrests for assault and battery (males), 36,627 police records.
5. Arrests for assault and battery (females), 3981 police records.
6. Arrests for drunkenness (males), 44,495 police records.
7. Arrests for insanity (males), 2467 police records.
8. Arrests for insanity (females), 1097 police records.
9. Suicide, 2946 police and coroner's records.
10. Deaths, 74,793 board of health records.
11. Policemen off duty for sickness, 191,137 police records.
12. Clerical errors, 3698 bank records.

The whole number of data considered is 497,262.

Of these data, class 1 was studied in order to determine the influence of the less easily recognizable meteorological conditions upon the attendance; class 2 represents the number of pupils who received bad marks for deportment from the registration of class 1; class 3 shows the number of convicts who were in the dark cells in the penitentiary on Randall's Island during the years covered by the study; classes 4, 5, 6, 9, and 10 are sufficiently self-explanatory; classes 7 and 8 are for persons taken to the asylum by the police, for the most part representing initial attacks of insanity or the beginning of recurrent attacks; class 11 covers single days leave of absence by members of the metropolitan police force, and was studied in order to discover, if possible, some fixed relation between the weather and health; class 12 represents the clerical errors made by the employees in several of the larger national banks in the Wall Street district, and was considered in order to determine any concomitance in the fluctuations of weather and mental exactness.

Knowing, then, the exact occurrence of each of these phenomena of conduct for each day of a series of years, and also the exact meteorological condition for each of those days, it was possible by a laborious process of tabulation to determine for which of the latter the former (i. e., the phenomena of conduct) were of normal prevalence, or above or below the normal. Discrepancies between the normal or expectancy curve and that of occurrence of any of the abnormalities of conduct studied were attributed to meteorological influences.

The right to do so is claimed first, since of all conditions the weather is the only one which varies simultaneously for all individuals in a given community, and second, since enough data have been considered to practically eliminate from the results all other influences which bear an accidental relation to the weather.

If, then, in a community of 2,000,000 people we find that regularly for a series of years certain misdemeanors become excessive during the prevalence of particular meteorological conditions, we claim that the relation is one of cause and effect, and this is what we do find.

The number of meteorological conditions studied was 67: For temperature, 19 (each 5° F., from 0° to 95°); for barometer, 15 (each .1 inch, from 29.10 to 30.60 inches); for relative humidity, 14 (each 5 per cent, from 30 to 100 per cent); for wind, 14 (each 50 miles total daily movement, from 50 to 750 miles); for character of the day, 3 (clear, fair, cloudy), and for precipitation, 2 (none and some).

It is not within the scope of this paper to discuss in detail the results of my studies. If one is interested in them, he may find them all, with one exception, in the papers referred to in the footnote. The exception is the study of the New York police which has not been published, since the results were entirely negative. Seemingly, the metropolitan guardians of the peace are immune to weather influence, for in no case did the curve for absence from duty vary from that of expectancy to a greater extent than the mathematically computed probable error.

A single, broad generalization is all I shall hope to make. It is this, that the various meteorological conditions affect directly the metabolic processes of life, some increasing the vital or reserve energy, others tending to its depletion, and that the resulting emotional and intellectual states are those which are common to conditions of excessive or depleted vitality. This conclusion is arrived at on entirely *a posteriori* grounds from a careful study of the discrepancies between expectancy and occurrence curves for the various classes of data studied. It was noted, for instance, that each definite meteorological condition affected the various abnormalities of conduct studied in opposite ways, increasing the frequency of some while retarding that of others. Further inspection showed that it was possible, on the basis of those effects, to divide the data of conduct into two general classes, all those in each class being affected similarly by each of the meteorological conditions. Those which were thus thrown together were: Class A, absences from the public schools, drunkenness, death, and clerical errors. Class B, misdemeanors in the public schools and penitentiary and arrests for assault and battery and insanity. In some respects fluctuations in the occurrence of suicide were analogous to those of class A. Analysis of these various activities or cessations of activity furnishes the ground for my thesis that weather states influence directly the vital energy, since it seems true that all the activities of class B are due to its excess, while those of class A have their origin in its deficiency. To

[1] Author's summary of a memoir read before the American Association for the Advancement of Science, Washington, D. C., January 31, 1903.

[2] Fuller studies discussing these data in detail have been published as follows: Conduct and the Weather; Monograph Supplement, No. 10; The Psychological Review; The Pedagogical Seminary, April, 1898; The Scientific American Supplement, June 3, 1899; Science, August 11, 1899; Appleton's Popular Science Monthly, September, 1899; Educational Review, February, 1900; Nature, February 11, 1900; Annals of American Academy of Political and Social Science, October, 1900; Popular Science Monthly, April, 1901; International Journal of Ethics, July, 1901; Popular Science Monthly, April, 1902; Scientific American Supplement, August 30 and December 13, 1902.

consider the former, in the public schools, sins of commission rather than sins of omission are usually the occasion of bad marks in deportment. It is usually the active, energetic boy, the one with vitality to spare, who gets the demerits. The anemic youngster may never stand at the head of his class, but he is very likely to delight his fond mamma with a mark of 100 in deportment. If that be so, and I speak with authority upon this point if upon no other, disorder in the school room is an active thing, and an evidence of excessive vitality. With the penitentiary inmate I have had less experience, but upon *a priori* grounds would argue that what is true for the child in question of deportment would not be radically different for the adult.

With persons arrested for the crime of assault and battery the same is, I believe, demonstrably true. One might feel like fighting and perhaps more frequently does feel so when possessed of "that tired feeling" which is the fortune of patent medicine venders, but to feel like fighting without doing so, never brought a man before the police judge for the crime which we are considering. There must be both the inclination and the consciousness of strength to back it up before one would be likely to figure in this class of data.

In the case of arrests for insanity, we shall take the word of the psychiatrist that acute mania increases with any condition which tends to augment the output of nervous energy. The daily fluctuations in strength which all have experienced are not so much those of physical as of nervous energy (if this distinction may be made), and with any persons having tendencies to mania the results would be those which our records show.

But to return to those activities of life which vary in an opposite way to those just discussed. In the long run, absence from school is an indication of physical disability. In the case of drunkenness, it seems to me beyond a doubt that with the several classes from which my data were secured the problem of vital energy enters in and that excessive drunkenness is an indication of its depletion. We may, I believe, with justice conclude that many of the habitués of the police court as prisoners struggle against their tendencies to drink, knowing the consequences. When vitality is excessive they do so with success, for days and perhaps for weeks they are winners, but finally the time comes when the fight is too severe and they succumb. That was the day when vitality was at its lowest ebb.

If, then, this general analysis be a correct one, the various meteorological conditions produce a direct result upon the metabolic processes of life, some of them tending to accelerate the production of vital energy, others to retard the process. For the want of better terms, though fully recognizing the inexactness of their application, I shall use the term anabolic as indicative of the former, katabolic the latter.

To consider very briefly the exact effects of the various meteorological conditions. Low temperatures seem generally katabolic, with gradually increasing anabolic tendency until a mean temperature of about 85° F. is reached, when a sudden change takes place and the effect upon available energy is disastrous. At this point active disorder reaches its minimum, while the death rate, suicide, and clerical error increase to an alarming extent. Low barometric pressure is anabolic in its effect, with the reverse for a higher mercurial column. As to conditions of relative humidity, a dry atmosphere is uniformly exhilarating (anabolic), while a moist one is correspondingly depressing. For no other one of the meteorological conditions is the effect so marked. A study which I made of the deportment of children in the public schools of Denver, Colo., where the prevailing condition is one of low humidity, but where occasionally atmospheric moisture reaches almost to the zero point, demonstrated that upon such successively dry days active disorder ran up to more than seven times the normal. For conditions of wind, strangely enough, calms are found to have a katabolic effect of tremendous magnitude in New York City. During their prevalence the death rate is abnormally high, and there are three times the normal number of absentees among the school children. At the same time the police courts practically go out of business. It seems probable to me that these conditions are practically the results of poor ventilation on a large scale.

For days of different character, as determined by the sunshine recorder and also by precipitation, we find influences such as would most naturally be expected; i. e., anabolic for the clear and dry, with the opposite for those of the other character. Deportment, however considered, is at its best on the cloudy, wet days, while the death rate is high. Suicide, however, here shows a peculiar anomaly in that it is excessive on the bright, dry days.

Some interesting facts not already alluded to are suggested by my studies, and in conclusion I mention two of them:

First. There would seem to be reason to infer that the influence of the state of the weather upon children is more marked than that upon adults.

Second. That women seem to be more sensitive to such influence than men. Evidences of this are to be found in the study of arrests for assault and battery, where the sexes were tabulated separately.

In explanation of my own conception of the whole problem of weather influences, I would say, in closing, that we can not suppose peculiar meteorological conditions to be the immediate cause of many of the abnormalities of conduct which vary with them. I have determined that suicide is much more frequent when the barometer is low than when it is high, yet would not wish to assert that low barometrical conditions ever drove a man to self-destruction. The only thing supposable is that during such atmospheric conditions the general emotional states are of such qualities that other things are more likely to do so.

This would be just as true for any of the other abnormalities of conduct studied. We can, on the strength of the whole series of studies, claim to have demonstrated that the metabolic processes of life to some extent vary with the weather states and that these variations in metabolism make themselves evident both through physiological and psychological manifestations. More than this we do not at present claim.

ELASTICITY AT LOW TEMPERATURES.

By J. R. BENTON, Ph. D. (Göttingen, 1900), dated Washington, D. C., February 20, 1903.

The subject of elasticity of solids has perhaps a less direct interest for the meteorologist than some other branches of science; it must, however, claim some attention on account of the use of numerous meteorological instruments whose action depends on the elasticity of springs. It is important to know how the indications of Vidi aneroids and Bourdon pressure gages, of air thermometers, and of pressure anemometers are affected by changes of temperature producing changes in the elasticity of important parts of these instruments. Since in making observations at great altitudes, the meteorographs are exposed to very low temperatures, it is desirable, in particular, to know how elasticity is influenced by extreme cold.

But few general statements can be made in regard to the variation of elasticity with temperature. In almost all substances the elasticity decreases with rising temperature; yet this general rule has an exception in the case of vulcanized india rubber, which, under certain conditions, becomes more elastic as its temperature increases. It is a general rule, also, though not a universal one, that the rate of change of elasticity with temperature, for a given substance, is greater as the temperature is higher. Comparing different substances,

we find that, in general, a given change of temperature (say from 0° to 1°) produces the greatest change in elasticity in those substances which are nearest to their melting points, and the least change in those which are farthest from their melting points.

Excepting such rough qualitative rules as the above, we can not, in the present state of science, make any *a priori* statements regarding the effect that a given temperature may be expected to have on the elasticity of a given substance. The only way by which we can obtain reliable and exact knowledge on this point is by direct experiment.

Many experiments have been made on elasticity at temperatures above the ordinary, and a few at temperatures as low as —15° C. (5° F.). Until lately no experiments at lower temperatures had been made, for the reason that, until very recent years, the difficulties in the way of producing lower temperatures have been prohibitive of their use in research. These difficulties have now been overcome by the introduction of methods for producing liquid air in considerable quantitities, and at a cost which, though still great, is within the means of many laboratories. The temperature of liquid air, boiling at atmospheric pressure, is approximately —186° C. or —302° F. Lower temperatures, although attainable, are not yet generally available; and the temperature of liquid air may be regarded at present as a sort of lower limit of temperature, above which numerous and extended investigations of most physical phenomena have been made, but below which only few and isolated researches have yet been carried out.

Prof. James Dewar discovered in 1894 that the strength of metals is greatly increased by the extreme cold of liquid air; and this led him to think that a similar increase in elasticity might take place at low temperatures. He found that such an increase occurred in the case of a wire of fusible metal. The wire was bent into a spiral; at liquid air temperature it supported a weight of two pounds and vibrated like a steel spring, while at ordinary temperatures it was pulled out straight by an ounce weight. Another instance is furnished by india rubber; at ordinary temperatures it offers but little resistance to distorting forces, and consequently has but little elasticity of rigidity; when cooled to liquid air temperature its elasticity is greatly increased, and it becomes stiff and brittle, like glass.

There is no reason, however, to expect that metals like steel and copper increase in elasticity at low temperatures as much as india rubber or fusible metal, because, as stated before, it is the general rule that substances having high melting points vary in elasticity less for a given change of temperature than do those of lower melting points. The melting points of steel and copper may be taken as 2500° F. and 2200° F., respectively; while those of india rubber and of Dewar's fusible metal may be taken as 300° F. and 400° F.

Experiments were carried out by the writer to ascertain how much the elasticity of steel and of copper is changed by cooling to the temperature of liquid air.[1] It was found that the change is a very appreciable one, although, as anticipated, not nearly as great as that observed in Dewar's fusible metal. The numerical results obtained are given in the following paragraph:

At —186° C. or —300° F., Young's modulus for steel is greater than at 20° C. (65° F.) by 8½ per cent; Young's modulus for copper is greater than at 20° C. (65° F.) by 18 per cent; the modulus of torsion of steel is greater than at 20° C. (65° F.) by 7 per cent; the modulus of torsion of copper is greater than at 20° C. (65° F.) by 6 per cent.

These results are exhibited graphically in the accompanying figs. No. 1, 2, 3, and 4, in which the abscissas represent temperatures in centigrade degrees, and the ordinates represent the corresponding values of the elastic moduli, expressed in terms of their values at 20° C. (65° F.); the values at —186° C. are the results of the writer's experiments, those at higher temperatures are taken from the experiments of Pisati and Wertheim.

[1] An account of the writer's experiments is given in the Physical Review. Vol. XVI. January, 1903. Pp. 17–27.

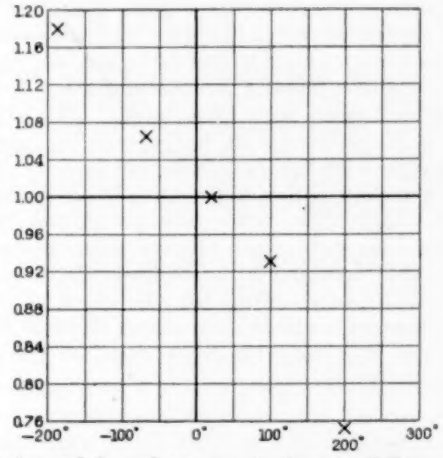


FIG. 1.—Young's modulus of copper, in terms of its value at 20° C. Wertheim's results for high temperatures. My result for —186° C.

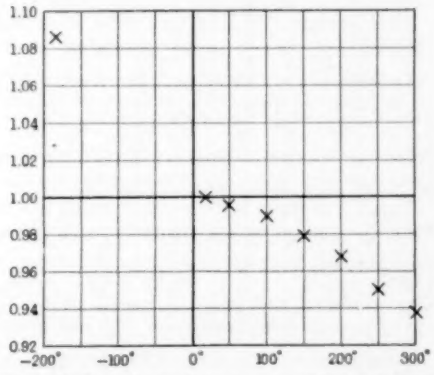


FIG. 2.—Young's modulus of steel, in terms of its value at 20° C. Pisati's results for high temperatures. My result for —186° C.

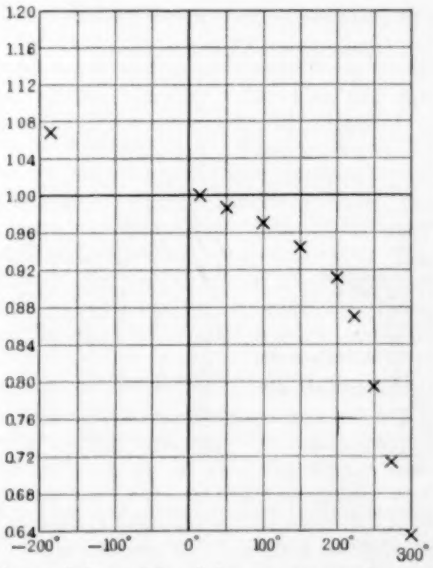


FIG. 3.—Rigidity modulus of hard drawn copper, in terms of its value at 20° C. Pisati's values for high temperatures. My result for —186 C.

Of these results the one most interesting in connection with meteorological instruments is that for the modulus of torsion of steel, since steel is the metal most commonly used in springs, and since elasticity of torsion determines the behavior of a helical spring. This result enables us to calculate what influ-

ence low temperature may be expected to have on the indications of an instrument whose action depends on a steel helical spring. The effect of temperature on such instruments is often ascertained more conveniently by trial than by calculation; but when the instrument is to be used at temperatures outside of the limits between which it has been tested, recourse must be had to calculation, usually by extrapolation from the temperatures at which tests have been made. It is always a question how far it is justifiable to carry such extrapolation; for the rate of change with temperature may be very different outside the limits within which tests have been made from what it is inside of them. The writer's experiments show that at low temperatures no very great change takes place in the manner in which the elasticity of steel depends on temperature; and that, therefore, in allowing for the effect of low temperature on an instrument whose indications depend on the action of a steel spring, it is possible to extrapolate from the results of tests at higher temperatures.

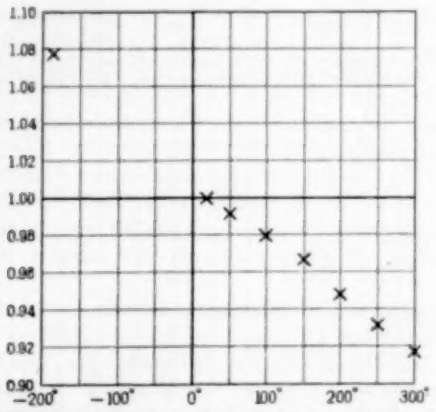


FIG. 4.—Rigidity modulus for steel, in terms of its value at 20° C. Pisati's results for high temperatures. My result for —186° C.

THERMOMETRIC OBSERVATIONS AT SANTA FE, ON THE ISLE OF PINES.

Communicated by E. W. KELLOGG, M. D.

Isle of Pines temperatures during December, 1902.

[Observed with a spirit thermometer.*]

December.	6 a. m.	Noon.	9 p. m.	Weather.	December.	6 a. m.	Noon.	9 p. m.	Weather.
	°	°	°			°	°	°	
1..	74	86	76	Clear.	17..	74	83	75	Clear.
2..	74	87	76	Clear.	18..	72	80	72	Clear.
3..	74	86	76	Clear.	19..	70	79	69	Clear.
4..	76	88	78	Light showers.	20..	71	80	72	Clear.
5..	76	81	76	Partly cloudy.	21..	70	80	72	Clear.
6..	74	82	76	Clear.	22..	65	80	74	Clear.
7..	76	82	76	Clear.	23..	65	75	70	Clear.
8..	72	78	72	Clear.	24..	65	71	68	Clear.
9..	76	80	74	Partly cloudy and clear.	25..	64	70	70	Partly cloudy.
10..	72	81	76	Clear.	26..	69	72	68	Clear.
11..	74	80	76	Light thundershower.	27..	60	73	66	Clear.
12..	72	83	78	Clear.	28..	58	72	67	Clear.
13..	76	85	76	Clear.	29..	67	78	71	Clear.
14..	76	83	76	Clear.	30..	70	78	71	Shower and clear.
15..	75	82	74	Clear.	31..	72	82	72	Clear.
16..	74	83	76	Clear.					

* Nothing is at present known of the accuracy of this spirit thermometer, but it is hoped that the observer will eventually provide a reliable mercurial thermometer and make the necessary comparative readings.—*C. A.*

VIOLENT WIND IN SOUTH DAKOTA.

By S. W. GLENN, Local Forecast Official, dated Huron, January 15, 1903.

The wind, which was from the northwest, attained a maximum velocity of 48 miles per hour; a special observation was taken at 2:40 p. m. of the 6th and sent to the district forecast center. Because of an increase in pressure of .12 inch in two hours, another was taken at 5:20 p. m. and sent; and at 6:20 p. m. another was sent because of a 64-mile per hour wind and a possibility of no wires being available for the regular p. m. report. It was only through the courtesy of the train dispatcher of the Chicago & Northwestern Railway, who had an outlet for about five minutes, that the p. m. report got off.

The a. m. report of the 7th was promptly filed, but it was later learned that it did not get off in time for the St. Paul circuit, so was sent by mail with an explanation relative thereto. There was practically no outlet by wire from the time that the p. m. report of the 6th was sent until the late afternoon of the 7th, due to the wires being down, or in trouble.

On the 7th as soon as a wire was available, a special observation was taken and sent to Chicago, showing the conditions from 8 a. m. up to that time.

After 2:20 p. m. of the 6th the wind steadily increased, with occasionally some abatement for short periods, until about 10:45 p. m. when it attained a maximum velocity of 72 miles per hour, after which time it very slowly diminished, though it continued high most of the 7th.

A number of clippings relative to the storm have already been forwarded, but those applying to Huron and the vicinity are somewhat exaggerated. A portion of the flat tin roof of the Presbyterian College, a four-story structure, was torn away about two hours before the maximum wind velocity occurred, taking with it a portion of the brick coping that was in poor repair, and a portion of the débris knocked down a chimney of a near-by church and also of a residence. Several out-of-repair chimneys were blown down or damaged, and some loose and exposed outhouses were blown over. The south gable of an old one-story building was blown out, due to a draft from an opening on the north side. The roof of the college was a weak affair, and I am informed the wind had access below and under the roof from a broken window.

Farmers in the county report some wind mills with old wooden supports blown down, and hay stacks uncovered.

The Chicago & Northwestern Railway train service was greatly interrupted by the storm, due to snow blowing into the cuts.

In the county adjoining on the east, two men and some animals were reported killed by a shelter being blown in.

The Weather Bureau instrument shelter is fully exposed to the force of the wind from all directions, but the thermograph trace during the storm does not show a very marked vibration.

Fortunately, there was no snow during the storm of any consequence, and the temperature was comparatively moderate during the gale.

The maximum velocity during the storm exceeded by three miles the highest ever before recorded at the station, which was 69 miles per hour in June, 1894, but the wind has equaled or exceeded 60 miles per hour in 21 previous storms.

The total movement from noon of the 6th to noon of the 7th was 1000 miles, or an average of 41.7 miles per hour.

THE VERTICAL COMPONENT OF THE MOVEMENT OF CLOUDS MEASURED BY THE NEPHOSCOPE.

By LOUIS BESSON, translated from the Annuaire, Societé, Météorologique de France, 1902, pp. 180–185.

In order to determine by means of a nephoscope the movement of a layer of clouds, it is usually considered sufficient to observe the direction of these from a point in the sky chosen arbitrarily. This is to admit implicitly that—omitting all accidental deviations—the same result would be found at any other point in the sky.

This, however, is not the case. The observations made at Montsouris show that in general the apparent direction of the motion of the clouds varies from one point in the sky to another and that the differences frequently attain a rhumb (22.5°), and even much more. In the great majority of cases the clouds seem to vary from one side to the other of their mean direction.

As an example I give an extract from our observations for the 20th and 21st of May, 1902. Each direction here given is the mean of 3 or 4 determinations made successively at the same point in the heavens. The directions are counted from 0° to 360° from north to west.

Year.	Time.	Kinds of clouds.	Location.	Altitude.	Movement.	Location.	Altitude.	Movement.	Difference.
1902.	H. M.			°	°		°	°	°
May 20	9 25	Nimbus	e.	35	27	w.	35	5	22
Do	15 30	Cirrus	ese.	35	39	wnw.	35	346	53
Do	18 20	Cirro-stratus	e.	30	355	w.	30	335	20
May 21	18 20	Alto-cumulus	e.	20	17	w.	20	350	27

If the cirrus only are considered, our observations show that in fifty cases the differences of the observed directions at two opposite points in the heavens were:

Cases.	Difference.	Cases.	Difference.
	°		°
1	55	10	15
2	30	13	8
7	25	9	5
5	20	3	0

This phenomenon is not peculiar to the Montsouris station. Thanks to the kind cooperation of M. Teisserenc de Bort, I have been able to ascertain that it exists also at Trappes. On March 20 simultaneous measurements were made at the observatory of dynamic meteorology at Trappes and at Montsouris using two identical nephoscopic diaphragms and following the same methods, as will be explained further on; these showed quite uniform differences of direction. The following is the résumé of these observations:

Hour.	Kinds of clouds.	Mean direction of movement.		Difference of movement.	
		Trappes.	Montsouris.	Trappes.	Montsouris.
		°	°	°	°
10 a. m.	Alto-cumulus	116	115	14	10
11 a. m.	..do	122	117	8	8
Do.	Fracto-cumulus.	120	114	11	8
12 m.	Strato-cumulus	122	114	5	6

What is the cause of these differences? The most natural hypothesis is that the movement of the clouds instead of being horizontal, as is usually supposed, has a vertical component, or in other words it is along an inclination. By this hypothesis the apparent direction, as given by the nephoscope, forms with the true direction of the horizontal component an angle, ε, which depends on the inclination, i, of the movement of the clouds, on the angular height, h, of the observed point above the horizon, and on the angle, a, made by the azimuth at bearing of this point with the true direction. The value of the angle, ε, which we call deviation, is given by the formula:

$$(1) \qquad \tan \varepsilon = \frac{\sin a}{\cos a - \cot i \tan h}$$

The deviation is always zero at the zenith. For the same altitude it is maximum when the azimuth of observation is perpendicular to the apparent direction. At the same azimuth it increases with the zenithal distance. At points of the sky symmetrical as regards the perpendicular to the apparent direction, the deviations are equal in absolute values, but are in opposite directions.

In order to define in a general way the direction of these apparent deviations, it may be said that the clouds seem to converge when they have an ascending movement and diverge when they have a descending one.

Conversely from the relation (1) there may be found the amount of the inclination, i, of the movement of the clouds as a function of the deviation observed at a point of the sky whose coordinates are a and h.

This gives:

$$(2) \qquad \tan i = -\frac{\sin \varepsilon \tan h}{\sin (a - \varepsilon)}.$$

The deviation, ε, may be considered as given directly by the observation. According to the remarks made above, ε is equal to the difference of the apparent direction of movement at a point whose coordinates are a and h and the movement at the zenith, or again to the half difference of the apparent directions at the two points whose coordinates are a and h, $-a$ and h.

If the azimuth of observation is perpendicular to the true direction of the clouds, the formula (2) becomes simpler.

(3) For $a = \pm 90°$, one has $\tan i = \pm \tan \varepsilon \tan h$.

Finally, if also $h = 45°$, we have simply $i = \pm \varepsilon$.

From this last remark a very simple method is deduced for determining by means of a nephoscope[2] the inclination of the motions of the clouds; it suffices to observe their apparent directions of motion at two points whose azimuths are perpendicular to the movement and whose altitudes are 45°. The angle of inclination may be obtained by taking the difference of the two observed directions of movement and dividing by 2.

In practise it is often impossible or disadvantageous to make observations at the height of 45° on both sides. It may, in fact, happen that the clouds under consideration are absent from that part of the sky or that the points of the clouds are not sufficiently distinct. In general, it may be necessary at each measurement, to make observations at different heights on each side. The simple formula $i = \pm \varepsilon$ will, therefore, not be always applicable, and it will often be necessary to make use of the more general formula (3).

We may here remark that $\tan i$, as given directly by this formula, is nothing more than the ratio of the vertical and horizontal components of velocity, or $\tan i = \frac{H}{V}$. It is more useful to know this ratio than the angle i itself, because it lends itself more conveniently to the calculation of mean values and allows the vertical velocity to be learned as soon as the horizontal velocity is known.

It is therefore very useful to compute once for all a table of double entry giving $\tan i$ as a function of ε and of h according to formula (3). The variations of ε should be by half degrees and of h by five degrees. This table will also be useful in cases where the observations may not have been made on the two sides at the same height. Starting then from the tabular line of numbers corresponding to the half difference of the observed directions, we move away the same number of lines, in opposite directions, but still in the columns corresponding to the two observed altitudes, until we arrive at the same number, or nearly so, which will be the value of $\tan i$, that is sought.

It may be useful to enter into some details of the technical part of these observations. On account of the irregular motion of the clouds, it is necessary to make several successive observations at each point of the sky where the apparent direction of movement is to be determined. By taking the mean of the observed values the accidental errors of observation and the variations of the two components of cloud motions will be more or less eliminated. Moreover, during the necessarily long duration of the observations the movement of the clouds may vary perceptibly. In order to avoid the error that would thus result in the value of ε, it will suffice to interchange the order of succession in making the measurements. For instance, if the clouds come from the north the

[2] For the description of this instrument, see the Annales of the Municipal Observatory of Paris, Vol. II, 1901.

observation will be made first in the east, then in the west, then again in the east.[3]

The azimuth of the points of observation will be determined without difficulty and with sufficient accuracy by comparing with the surrounding terrestrial objects whose azimuth have been determined once for all. As regards the altitudes above the horizon a more precise determination is necessary. We measure these at Montsouris in the following manner: As the ground surrounding the nephoscopic network is sloping, we have from the first used a small liquid level in order to determine the slope by the eye, and correct the relative velocity. This level is composed of a glass tube recurved four times at right angles, forming a rectangle, and containing a certain quantity of mercury; the two extremities, brought close together, are joined by a piece of rubber tube in order that the mercury may not escape. This little instrument, very portable and easy to make, enables one to measure the slope to within one or two centimeters at 20 meters distance. It can also show the angular heights within 1°. For this purpose the glass of the mercury level is graduated on the two opposing branches for a certain position of the instrument in the vertical plane, then it is made to turn in this plane successively 5°, 10°, or 15°, and at each turn it is marked to show the level of the mercury. The instrument being thus graduated, then in order to obtain the angular height of any object whatever, it suffices to sight at this object, making use of the two marks corresponding to the initial position and to note at which degree of the graduation the level of the mercury stands.

Together with the direction of movement it is indispensable to determine the relative velocity of the clouds. The knowledge of this fact assures us that the respective points observed are really of the same nature and enables us to avoid confounding different layers of clouds. Besides, if the movement is inclined, the relative velocity is affected, like the direction, by an apparent modification, the law of which may be established theoretically. This question, however, we will not now consider.

Are the differences of direction observed at Montsouris to be attributed entirely to an inclination of the trajectory of the clouds? In order to examine into this subject we have for some time past, and as often as possible, made measurements at two different heights, generally at 20° or 25°, and at 40° or 50° from the horizon.

The following is a series of measurements made on the 15th of March, 1902, from 5:30 to 5:50 p. m. on a sheet of cirro-stratus cloud.

Coordinates.		Direction of movement.	$\frac{H}{V}$	Coordinates.		Direction of movement.	$\frac{H}{V}$
Azimuth.	Altitude.			Azimuth.	Altitude.		
	°	°			°	°	
Southwest	20	22	206	Northeast	40	39	212
Southwest	40	25	205	Northeast	20	50	205
Northeast	40	36	213	Northeast	40	40	223
Northeast	20	43	198	Southwest	40	28	181
Northeast	40	40	213	Southwest	20	31	206
Southwest	40	32	200	Southwest	40	28	195
Southwest	20	26	217	Northeast	50	39	227
Southwest	40	27	202	Northeast	20	39	205

Summary.

Azimuth.	Altitude.	Direction of movement.	$\frac{H}{V}$
	°	°	
Northeast	20	44	210
Northeast	40	39	197
Southwest	40	28	218
Southwest	20	26	203
Mean		34	207

[3] So in the original text, but the best order is E–W–W–E.—*C. A.*

From the deviations observed, respectively at 20° and at 40°, there are deduced two values of *tan i*, which should be equal at least on the average, if the hypothesis of inclined movement suffices to account for the phenomenon.

We have not yet been able to make a very great number of determinations of this kind; in order that they should be practicable, it is necessary that the clouds should present over the whole heavens a homogeneity and a stability of form which is very seldom attained. At all events the results obtained up to the present time appear to me sufficiently clear to enable us to consider the question as about settled.

Out of 21 cases of fracto-cumulus and fracto-stratus 11 show a value of tan i greater at 45° than at 20°, if the descending movement be taken as the positive direction. If the algebraic mean of the 21 values of tan i be taken, we find at 20° tan i= 0.23; at 45° tan i=0.31.

The difference which is 0.008 represents an excess of deviation of 0.5° at 45°. The mean deviation at this altitude is about 2°.

Out of 13 cases of alto-cumulus clouds 9 show a greater value of tan i at 45° than at 25°. The mean values are, at 25° tan i=0.043; at 45° tan i=0.073.

The difference of 0.030 represents an excess of deviation of about 1.5°: the mean is 4° at 45° of altitude.

Out of 16 cases of high cirrus, cirro-stratus, and cirro-cumulus 12 show a value of tan i greater at 45° than at 20°. The mean value of the tangent is, at 20°, 0.046; at 45°, 0.080.

The difference, 0.034, represents an excess of deviation of 2°; the mean is 4.5° at an elevation of 45°.

It will thus be seen that the deviations observed at Montsouris accord very nearly with the law of inclined movement for the lower clouds, but depart more and more from it if we pass to the medium clouds and then to the elevated ones. For these last particularly is the disagreement striking and unanswerable. The occurrences take place as if there were superposed over the action of a general cause, a disturbing element the effect of which seems to be to increase the apparent deviation in the neighborhood of 45° of elevation, and which affects either the vertical component of motion, or the horizontal component, or even the two together; this influence is more apparent in proportion as the clouds are more elevated.

There are reasons for thinking that the greater part, if not the whole of this disturbance, consists in a real variation of the direction of movement of the clouds. Many zenithal observations made simultaneously during several years at the Tour Saint-Jacques and at Montsouris show that the clouds above these two stations generally have perceptibly different directions. In particular, if we consider the cases where the movement of clouds is nearly perpendicular to the straight line which unites the two stations we find that there is, in general, a divergence for all kinds of clouds. Nevertheless, for the cumulus clouds in summer convergent directions are most frequently observed in the warmest hours of the day.

A long time ago M. Renou pointed out the existence of systematic differences in the direction of the lower wind around Paris; differences that Teisserenc de Bort has attributed to the influence of the population of Paris. Our observations tend to prove that this influence, probably of calorific origin, extends up to a considerable height and on the average manifests itself in the cloud regions by an expansion of the currents of air.

I will not dilate further at present on this phenomenon, the data which we possess being still too incomplete.

It is very desirable that observations with the nephoscope should be made at various stations, according to the method explained by us. In the open country, or generally outside of every disturbing cause, there is no doubt but that the deviations vary with the zenithal distance, according to the inclined movement.

CLIMATOLOGICAL TABLES FOR MERZIFOUN, TURKEY.

The following tables of monthly and annual values of pressure, temperature, and precipitation are furnished by J. J. Manissadjian, Professor of Physical Science, Anatolia College, Merzifoun, Turkey in Asia, and are a continuation of similar data furnished by him and published in the MONTHLY WEATHER REVIEW of June, 1897, page 245.

The location of the observatory is latitude 40° 50′ north, longitude 35° 40′ east.

Barometer records at Anatolia College, Merzifoun, Turkey in Asia.

Observations made at 7:15 a. m. and 1:45 and 9 p. m., reduced to 0° C. The reduction to standard gravity, −0.26 mm., has not been applied.

Month.	1898.	1899.	1900.	1901.	1902.	Average.	Minimum.	Date.	Maximum.	Date.
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*		*Mm.*	
January	696.5	692.1	693.0	693.3	693.2	693.62	681.5	25, 1898	**704.2**	3, 1898
February	691.0	690.0	689.6	691.9	693.4	691.18	682.5	12, 1898	700.5	27, 1898
March	689.2	690.5	689.5	691.0	688.8	689.80	**677.0**	13, 1902	703.3	21, 1900
April	691.2	690.9	693.9	691.7	689.8	691.50	681.5	2, 1900	697.8	17, 1898
May	689.6	691.9	690.3	689.7	691.1	690.52	680.3	4, 1901	697.0	21, 1900
June	691.5	689.8	691.3	692.3	690.4	691.06	683.8	19, 1899	697.0	5, 1899
July	689.7	691.0	690.3	689.8	690.4	690.24	685.2	14, 1901	696.0	21, 1900
August	690.7	690.7	683.7	689.3	691.2	690.32	681.4	6, 1901	694.8	18, 1902
September	692.7	691.8	693.8	691.3	694.2	692.88	688.0	15, 1899	700.1	27, 1902
October	693.5	694.0	695.2	693.4	694.6	694.14	685.8	25, 1900	699.8	23, 1899
November	695.6	695.0	694.1	692.2	692.4	693.86	682.9	30, 1901	701.0	27, 1899
December	695.1	693.2	692.3	692.7	691.2	692.90	682.0	31, 1900	700.8	28, 1898
Average	692.19	691.74	691.91	691.60	691.73	691.83	.....	.....	.....	.....

The lowest air pressure observed was 677 millimeters on March 13, 1902; the highest was 704.2 millimeters on January 3, 1898.

Thermometer records at Anatolia College, Merzifoun, Turkey in Asia, for ten years, 1893 to 1902; observations made at 7:15 a. m. and 1:45 and 9 p. m.; $average = \frac{7:15 + 1:45 + 9 + 9}{4}$.

Month.	1893.	1894.	1895.	1896	1897.	1898.	1899.	1900.
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
January	2.06	0.49	6.50	0.56	3.69	**− 6.50**	− 0.92	3.48
February	−1.09	0.18	6.39	0.49	3.70	3.32	2.25	5.75
March	4.69	5.41	6.56	5.60	8.15	5.52	5.45	3.95
April	4.98	11.18	10.65	9.31	13.57	11.30	11.45	11.03
May	16.24	17.80	13.60	15.47	19.11	13.52	16.85	15.00
June	19.55	20.26	19.15	20.27	23.41	16.87	16.98	17.83
July	22.98	21.93	23.46	22.78	**24.97**	21.45	19.73	20.98
August	21.79	21.98	22.89	24.49	23.60	20.12	20.50	20.65
September	17.39	17.25	16.34	20.43	21.36	16.40	20.00	14.55
October	14.73	16.86	15.82	17.37	14.86	14.45	10.95	13.42
November	11.28	6.66	9.27	8.86	3.24	6.68	4.23	5.56
December	4.12	3.45	5.21	4.85	2.11	0.73	0.62	4.25
Average	11.575	11.954	12.153	12.540	13.480	10.322	10.672	11.371

Month.	1901.	1902.	Average.	Absolute.			
				Minimum.	Date.	Maximum.	Date.
	°C.	°C.	°C.	°C.		°C.	
January	− 0.52	− 0.38	0.846	−16	1898	22.5	1895
February	4.85	5.20	3.102	**−19**	1893	20	1901
March	9.80	5.23	6.040	−10	1898	27	1901
April	11.70	9.95	10.512	− 6	1893	29.5	1898
May	13.70	15.00	15.629	1.5	1900	33	1899
June	20.47	18.55	19.334	5.0	1899	35	1899
July	21.50	18.17	21.795	3.0	1892	34	1897
August	21.85	20.18	21.805	9.0	1902	**37.5**	1895
September	16.60	14.92	17.524	1.0	1902	32.5	1897
October	11.65	11.63	14.174	− 1.0	1899	32	1897
November	5.90	2.75	6.443	− 7	1897	26	1893
December	4.93	0.84	3.111	−15	1897	20	1896
Average	11.867	10.170	11.693	.....	.....	.....	.....

The coldest year was 1902; the coldest month, January, 1898; the greatest cold was observed on February 10, 1903, with −19° C. The warmest year was 1897; the warmest month, July, 1897; the warmest day, August 6, 1895, with 37.5° C., which makes the observed range of temperature, 56.5° C.

Records of precipitation (rain, snow, etc.) at Anatolia College, Merzifoun, Turkey in Asia, for the period of seven years, 1896–1902, in millimeters.

Month.	1896.		1897.		1898.		1899.	
	Days.	Mm.	Days.	Mm.	Days.	Mm.	Days.	Mm.
January	6	10.13	3	24.08	12	32.0	4	13.2
February	3	3.89	7	26.67	9	24.0	11	58.4
March	4	31.05	7	24.38	4	18.5	8	37.0
April	5	30.90	12	56.39	10	32.2	14	109.4
May	17	93.76	19	91.25	17	82.3	2	32.7
June	10	70.68	11	70.92	12	82.4	11	79.6
July	3	32.20	3	3.08	1	0.4	6	25.4
August	1	10.10	2	17.04	0	0	3	46.5
September	5	59.82	2	24.08	3	24.4	2	11.7
October	2	8.76	7	29.14	5	74.9	11	46.0
November	4	46.86	5	12.66	3	16.4	7	54.6
December	6	19.43	8	31.70	7	32.3	4	17.3
Total	66	423.98	86	411.39	83	419.8	83	531.8
Snow	12	32.00	8	32.00	19	67.0	22	92.0

Month.	1900.		1901.		1902.		Average.		Maximum.	Date.
	Days.	Mm.	Days.	Mm.	Days.	Mm.	Days.	Mm.		
January	11	41.9	4	9.5	8	27.5	7	22.6	15.2	1900
February	6	15.6	7	44.9	9	21.3	7.5	27.8	27.6	1901
March	11	98.9	7	52.2	7	101.5	7	52.0	23.5	1901
April	8	62.0	8	69.1	7	40.5	9	58.1	24.0	1899
May	11	89.2	12	61.4	6	36.1	12	69.5	25.0	1900
June	10	62.8	7	68.8	5	16.8	9.5	64.6	32.0	1901
July	1	4.8	7	48.4	3	23.8	3.5	19.7	18.3	1901
August	3	18.4	3	47.9	1	11.4	2	21.6	**42.0**	1899
September	0	0	6	54.4	2	13.6	3	27.0	27.6	1901
October	2	14.9	4	16.2	3	14.2	5	40.6	38.0	1898
November	3	8.0	10	67.7	9	54.6	6	37.3	21.5	1899
December	6	51.7	6	70.8	7	66.0	6	41.3	25.2	1900
Total	72	468.2	81	611.3	67	427.3	77.5	482.1	.....	.....
Snow	12	63.0	6	42.0	16	71.0	13.5	57.0	*	†

* 15.2 millimeters of water equal to 33 centimeters of snow. † January 23, 1900.

The heaviest rainfall was 42 millimeters in three hours on August 15, 1899; one heavier in relation of time was 14 millimeters in twenty minutes on May 26, 1898. The heaviest snowfall was 33 centimeters of snow in one day on January 23, 1900. The average number of clear days (less than 0.2 of the sky covered) was 114; of cloudy days (more than 0.8 covered), 85; calm weather 505 observations (with 3 observations a day).

LOCAL PECULIARITIES OF SNOWFALL.

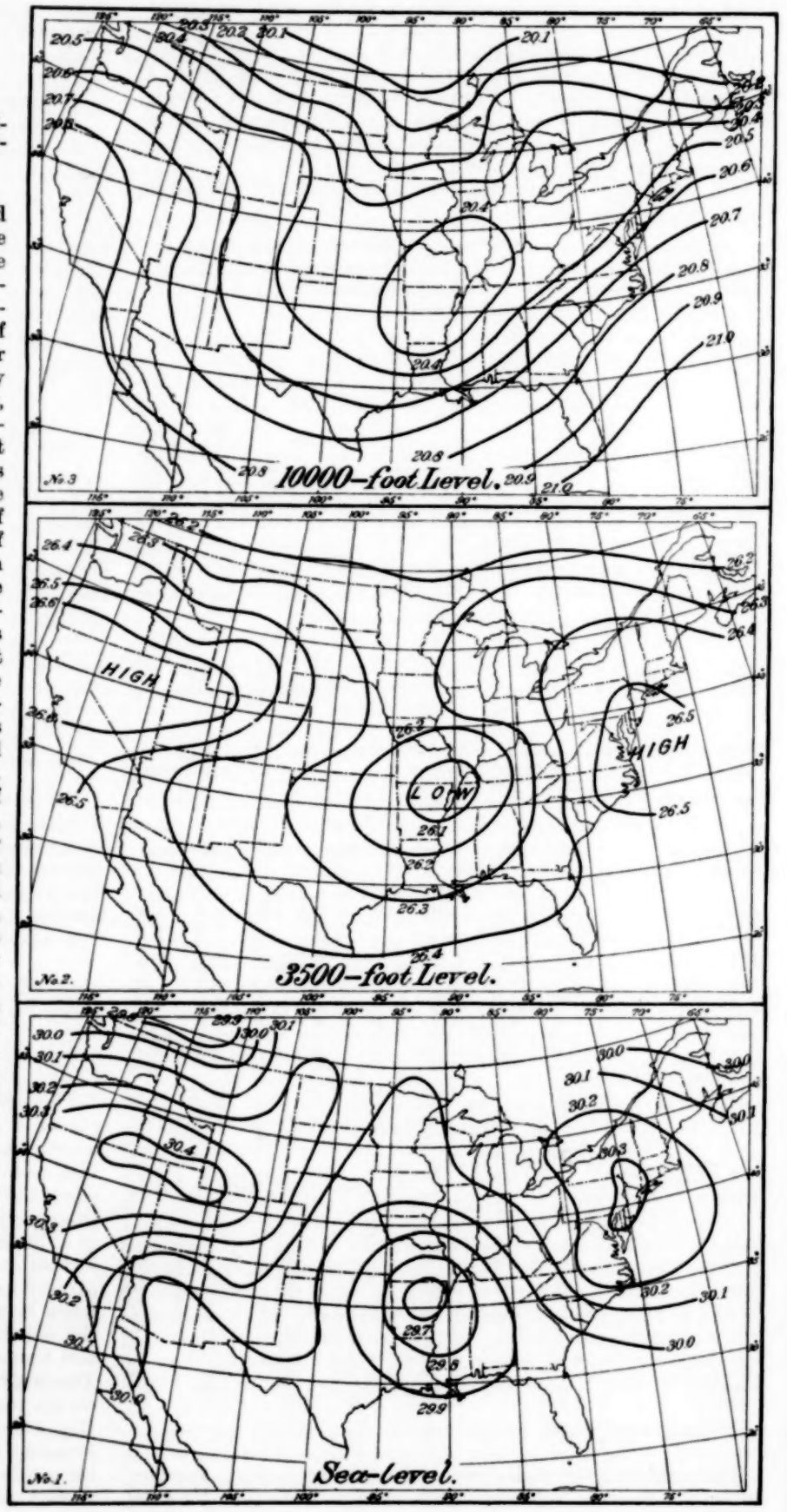
By E. L. MOSELY, Sandusky, Ohio, dated March 8, 1903.

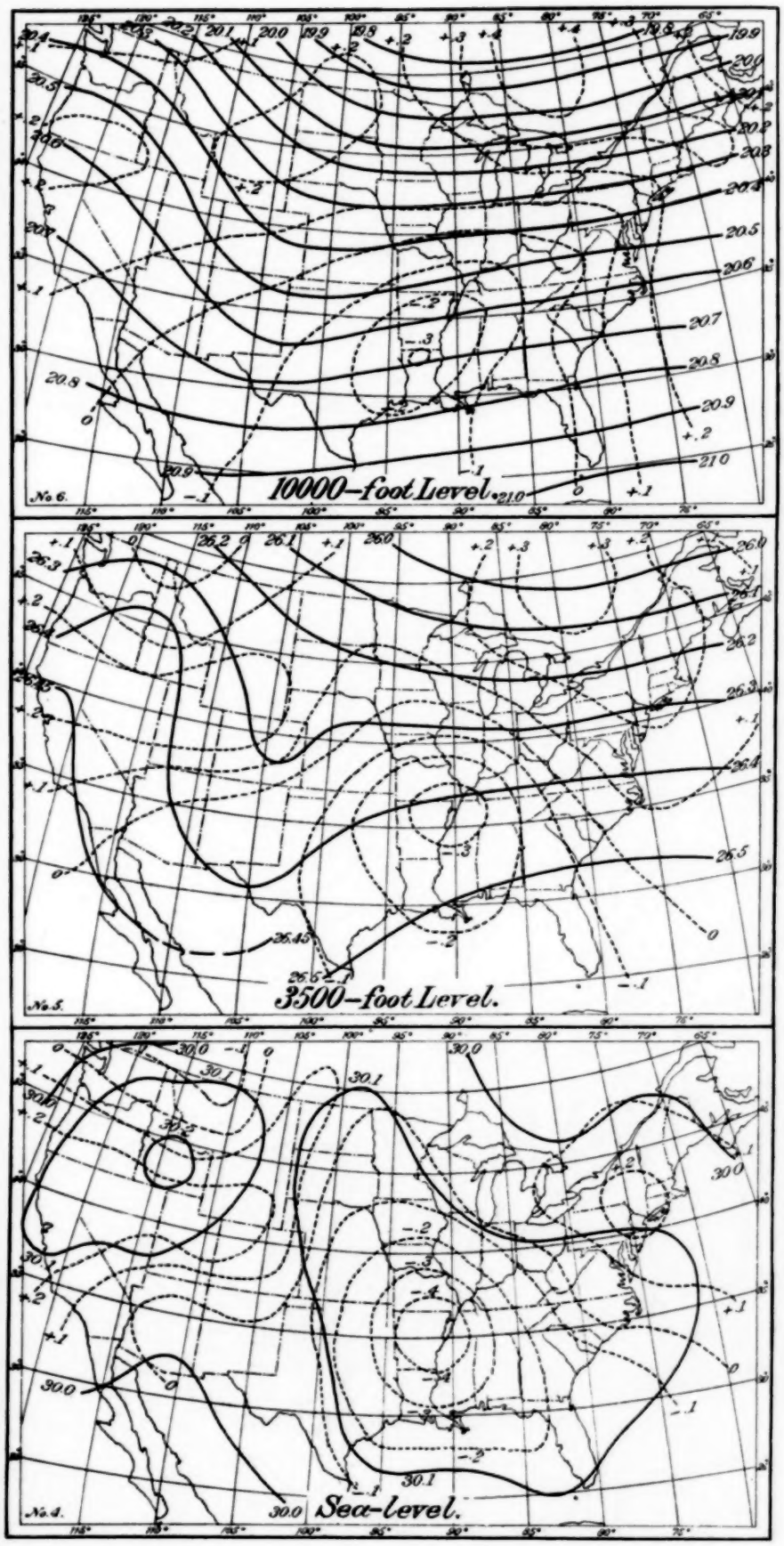
The snowfall at Sandusky is usually less than at other places in about the same latitude, the total for some winters amounting to only half that at Erie or Buffalo. The explanation seems to be as follows: Heavy snowfalls are most frequent when the temperature of the region is but little below the freezing point. At such times the temperature at Sandusky is a little higher than at places farther from Lake Erie or farther east along the lake, the latter being situated on higher ground as well as a little farther north. I recall one occasion when 10 miles south of Sandusky snow covered the ground to the depth of several inches; in Sandusky the flakes were large and numerous, but melted as they fell or soon after. Last Thanksgiving very little snow accumulated at Sandusky, but on the road to Columbus, when only two miles from Sandusky Bay, I noticed that the fields were whitened, the depth increasing farther south, where I noticed also a thin covering of ice on the ditches. For fifty miles or more the snow continued two or three inches deep. Reports made by pupils who were out of town for the holiday showed that in other directions considerable snow accumulated, excepting near the bay and on the peninsula between the bay and lake, where the snow melted as it fell.

THE STRUCTURE OF CYCLONES AND ANTICYCLONES ON THE 3500-FOOT AND 10,000-FOOT PLANES FOR THE UNITED STATES.

By Prof. FRANK H. BIGELOW.

The reconstruction of the theory of cyclones and anticyclones depends upon the determination of the velocities and directions of the air movements, the form of the isobars, and the distribution of the isotherms at several planes above the sea level. My report on the International Cloud Observations of 1898–99 gives the result of the survey of the upper air for the vectors of motion; this was supplemented by a series of papers in the MONTHLY WEATHER REVIEW, January to July, 1902. My report on the Barometry of the United States, Canada, and the West Indies, 1900–1901, has provided the necessary means for reducing the observed station pressures to three standard planes. The observational requirements of the problem will be completed by the discussion of the temperatures and vapor tensions, which has been already begun, though it will take considerable labor to finish the research. Meanwhile, it is profitable to make use of the material at hand in a series of studies on the circulation of the atmosphere at different levels up to two or three miles above the sea level. Beginning with January, 1903, the successive MONTHLY WEATHER REVIEWS will contain charts showing the mean monthly isobars on the sea-level plane, the 3500-foot plane, and the 10,000-foot plane. By comparing these pressures with the series of normal pressures given on the charts of chapter 7, Barometry Report, we can find the departures for each month on these three planes, and a discussion of such departures from year to year, when studied in connection with other phenomena, will have an important bearing upon the discovery of the laws for use in seasonal forecasting. Similarly, monthly temperature charts are given, and these are constructed by means of the temperature gradients which can be obtained from the data in Table 48, of chapter 8, of the same report, by subtracting the values of t from t_0 (sea level), t_1 (3500-foot), t_2 (10,000-foot) in succession. The latter temperatures were found by a process which eliminated the local abnormalities contained in the observed station temperatures, and they have permanent value. The surface temperatures of the several stations need to be further revised, and so we can claim at present for the temperature gradients only an approximate correctness. This imperfection will not greatly influence the position of the mean isotherms, but the reduced temperatures of neighboring stations do not appear on the maps quite as harmonious as we hope to make them by means of the revision just mentioned.





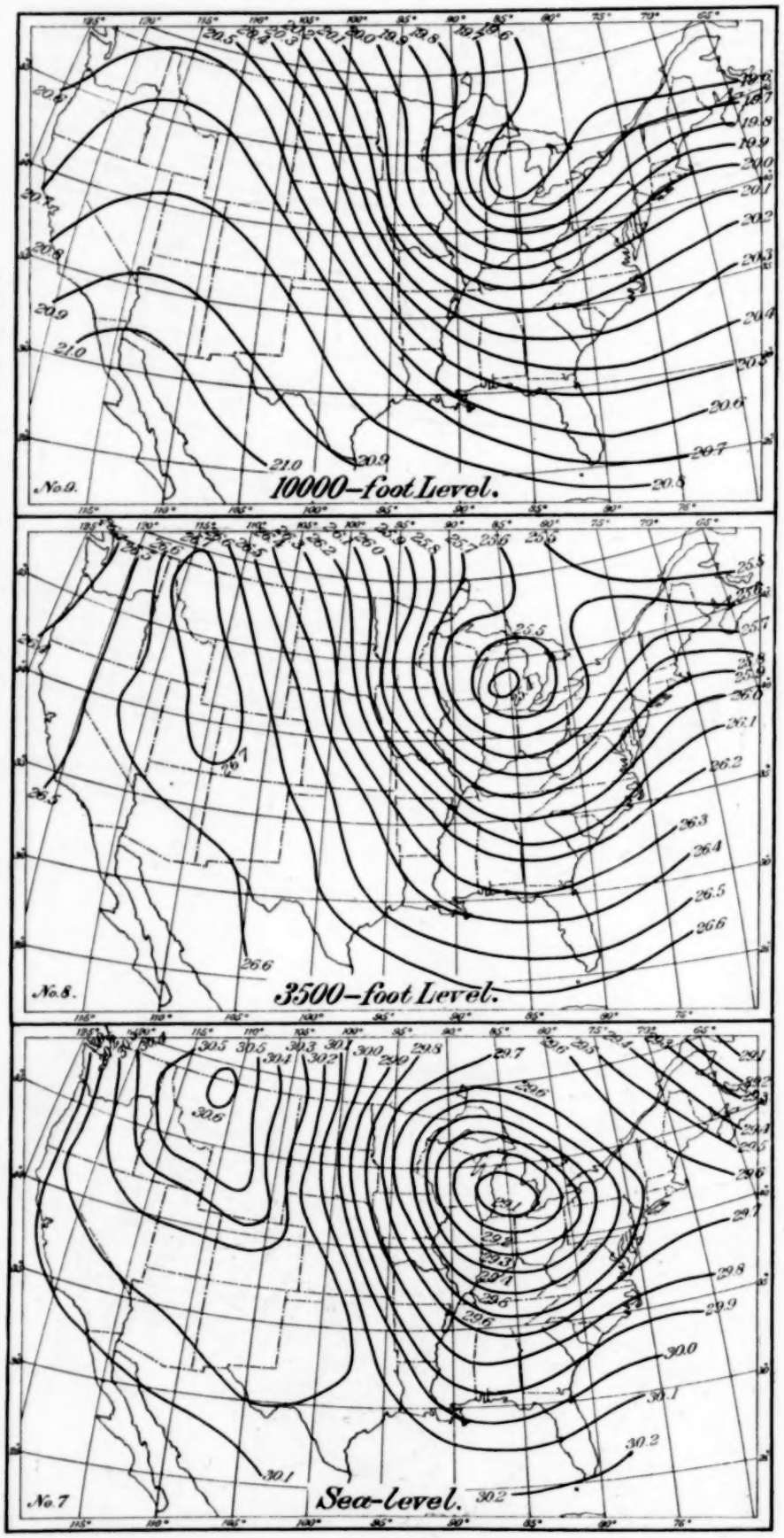
EXAMPLES OF SELECTED CYCLONES.

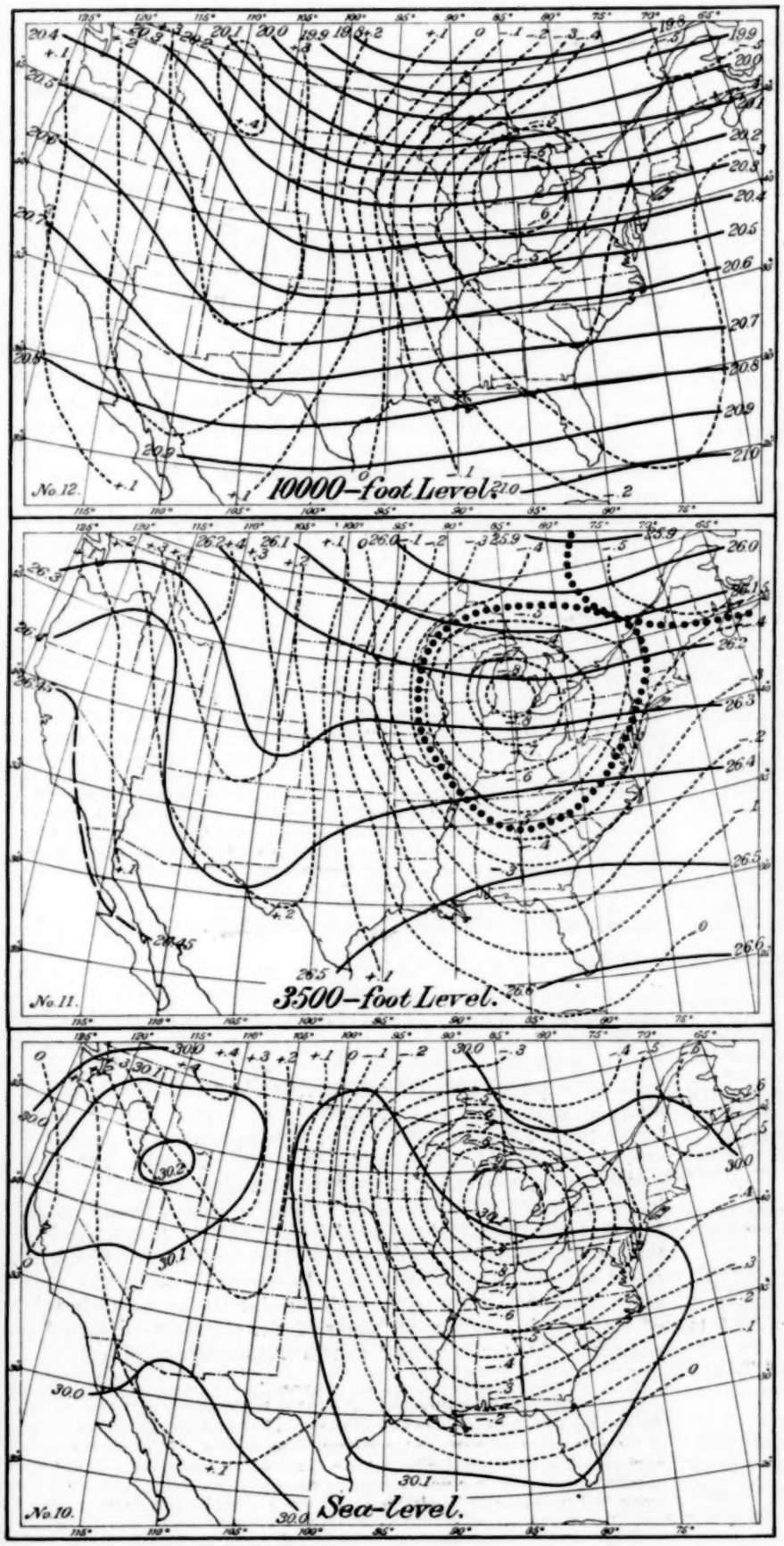
The construction of average vectors of motion and of mean isotherms as contained in the two reports on Clouds and Barometry produces a composite or resultant chart, and this is of value in discovering general relations and laws of structure in cyclones and anticyclones. It is, however, essential to determine the conditions prevailing in individual cyclones and anticyclones if we wish to apply the theories of hydrodynamics and thermodynamics in detail, so as to compute the relations between the dynamic and thermal energies on the one hand and the resulting forces that characterize the actual storm. For this purpose the station reduction tables of chapter 9 have been expanded, and tables have been furnished to the several stations for practical service. By means of these the observers at 175 stations are enabled to mail postal cards daily to Washington containing the (B, t, e) at the station and the reduced values of the pressure for the three planes, respectively. With this data, beginning December 1, 1902, we have prepared daily charts of pressure for the United States and Canada on the sea level, the 3500-foot plane, and the 10,000-foot plane, and we propose to discuss this material briefly in the MONTHLY WEATHER REVIEW preparatory to making a suitable general report on the entire subject. Prof. R. F. Stupart, Director of the Canadian Meteorological Office, is courteously cooperating with the United States by furnishing the daily postal cards for Canada.

For the month of January, 1903, we present two cyclones—that of January 2, central in the west Gulf States, and that of January 7, central in the Lake region—in order to illustrate typical configurations of the isobars on the upper planes. It is our intention to merely mention some of the salient features of these charts, since an inspection of them will doubtless suggest their true meaning to meteorologists better than any verbal description. They have special scientific interest from the fact that this is the first exhibit of the isobaric systems in the upper air surrounding individual cyclonic and anticyclonic centers.

January 2, 1903.—Charts 1, 2, and 3 are transcripts of the isobars as derived by computation in accordance with the system contained in the Barometry Report. We note (1) that the closed isobars of the cyclone at sea level tend to diminish in number and intensity at the upper levels and that they finally open out into shallow, inflected curves at the height of about two miles; (2) these curves in opening out first form cusp-shaped curves, joined together by a pressure which is higher than that north or south of it, whereby one closed isobar and one long or open isobar of the same name occur above and below the line of the cusps; (3) the high pressures to the east and west of the cyclone diminish in area and soon fade away into the long, looping isobars of the upper strata.

We now find the general normal and the local departure components of these observed isobars as follows: (1) The normal isobars for the month are copied on tracing paper in black lines, being extracted from the January charts of chapter 7; (2) these lines are laid over the observed isobars, and a new system of lines is constructed by tracing the diagonals of the quadrilateral figures thus formed, and these new lines are shown in red lines on Charts 4, 5, and 6. These curves give us in tenths of an inch the values of the local pressure disturbances which deflect the normal isobars, and they therefore measure the pressure effect of the local cyclone proper. The causes that produce these local departures of pressure must be the same as those that produce the cyclone itself. We may assume that the upper vectors of motion are parallel to the observed isobars, and we conclude that in this particular storm a current of air from the southeast is flowing upon the United States; that a part of it curls to the left and enters the vortex of the closed isobars, which generates a vertical component, and that the rest of this stream flows away by uniting with the normal general circulation. There seems to be also a minor stream of air from the northwest, and a portion of this enters the vortex.





January 7, 1902.—Charts 7, 8, and 9, are transcripts of the reduced pressures obtained in the same way; Charts 10, 11, and 12 give the normal monthly isobars, and the local isabnormals of pressure of a typical cyclone central in the Lake region. Here, again, the central closed isobars open out first into cusps with a feeble high pressure bridge, and then into loops which become flatter with the height, and finally disappear by merging in the normal lines. It is apparent that on the west side of the center a strong current from the north is chiefly concerned in building this cyclone, a part of it curling into the central vortex which has a vertical component, the remainder escaping eastward into the normal circulation. By comparing the vectors of Chart 23, International Cloud Report (blue arrows), we see that those vectors conform very closely to these isobars, and that they are generally parallel to each other. The component vectors of figs. 6 and 7, MONTHLY WEATHER REVIEW, March, 1902, show that the deflecting vectors also follow closely parallel with the isabnormals of pressure. The agreement of these three independent researches assures us that the analysis of the structure presented in my previous papers harmonizes closely with the observed facts. It is evident that if a series of coaxial circles about the center of the cyclone be superposed upon a system of parallel lines representing the general isobars, we should obtain resulting curves similar to those that have been produced by reduction of the pressures from the surface data. This involves an equation of three degrees and three characteristic areas, one central, one above the cusp lines, and one below them. (Compare fig. 11.) This analysis will therefore enable us to pursue the mechanics of cyclones into remote details, and so we shall at length be able to compare theory and observation with much precision. The subject will be further illustrated and discussed in later papers.

NOTES AND EXTRACTS.

THE METEOROLOGICAL REPORTER TO THE GOVERNMENT OF INDIA.

Sir John Eliot, who was knighted on the occasion of the coronation Durbar at Delhi, on January 1, will, we understand, resign his position as meteorological reporter to the government of India and director general of Indian observatories at the end of the present year. Mr. Gilbert T. Walker, M. A., Fellow of Trinity College, Cambridge, England, has been appointed assistant meteorological reporter and will proceed to India during the coming summer, with the understanding that he is to succeed Sir John Eliot on his retirement.

In connection with the above paragraph from Symons's Meteorological Magazine for February, we have been favored with the following biographical sketch by one who knew Mr. Walker in Cambridge:

Mr. Gilbert Thomas Walker, M. A., of Trinity College, Cambridge, England, was born in 1868, educated at St. Paul's School, London, and went to Cambridge in 1886. He was senior wrangler in the mathematical tripos in 1889. (The chief assistant to the astronomer royal, Mr. F. W. Dyson, also of Trinity, was second wrangler in the same year.) He obtained first class, first division in Part II of the mathematical tripos, in June, 1890, and in the following November took the B. Sc. degree at the University of London, being the first in mathematical honors. He was shortly afterwards elected Fellow of Trinity.

His first memoir, presented to the Royal Society, was read in December, 1891; its title was "Repulsion and rotation produced by alternating electric currents."

Shortly after this Mr. Walker became interested in the problem of the boomerang, which weapon he learned to use with great expertness. In 1895 he was appointed lecturer in mathematical physics at Trinity, where, in continuation of his interest in the mechanics of primitive implements and weapons, he often went out with one or two students to practise with the boomerang. He also discovered a curious dynamical property of "celts" and exhibited his collection of these stone implements at the Cambridge Philosophical Society in May, 1895.

His well known memoir on the dynamics of the boomerang was read in March, 1897, before the Royal Society in London and appeared in the Philosophical Transactions for that year, vol. 190 (A), and he has more recently discussed this subject in the Physikalische Zeitschrift, as also in Nature for 1901.

He returned, however, to his investigations in the mathematical theory of electricity and magnetism as his chief work, and when "The theory of the aberration of light" was announced as the subject for the Adams Prize for 1899, he proceeded to tackle this difficult problem.

His contribution, "Aberration and some other problems connected with the electro-magnetic field" (Cambridge University Press, 1900), as also that of Joseph Larmor, "Æther and matter; a development of the dynamical relations of the æther to material systems, on the basis of the atomic constitution of matter, including a discussion of the influence of the earth's motion on optical phenomena" (Cambridge University Press, 1900), were both successful. This was the first time, I think, in the history of this prize that two contributions of sufficient merit to obtain the prize were presented.

Since then he has continued this subject and published a memoir on "Some problems in electric convection" in the Transactions of the Cambridge Philosophical Society, Vol. XIX, pp. 173–189.

On account of the analogy between hydrodynamic and electrical theory, and in particular because he has been working with moving media, Mr. Walker will be in a position to make important contributions to the theoretical mechanics of the earth's atmosphere, now that his attention is to be directed to meteorological problems.—[J. D. T.]

BOMBARDING AGAINST HAIL.

As the newspapers of the country continue to publish articles advocating some species of cannonading as a means of dissipating destructive hailstorms, it is proper for us to call attention to the report on this subject that has just been published by the Meteorological Office in Vienna.

The hail shooting delusion seems to have originated in Italy, but soon spread into Austria. It was especially diffused by the enthusiasm of Albert Stiger and the firm of Carl Greinitz, Neffen, manufacturers of the Stiger apparatus. It was, therefore, very proper that an international conference of experts should be held at Gratz in July, 1902, under the auspices of the Austrian Department of Agriculture, to decide whether hail shooting is efficacious or not, and what is to be done in case this question can not be answered categorically. The report just published at Vienna contains an historical article by A. von Obermayer; a section describing the present methods, by Gustav Suschnig, and a review of the criteria for determining the efficiency of the shooting and the application of this criteria to the facts in hand, by Prof. W. Trabert. The whole report occupies 154 quarto pages.

In general, the cannonading with small apparatus and small charges of powder has proven itself useless in very many cases, and there is no evidence that one can attain absolute success by the use of small apparatus. With regard to large apparatus and large charges, which are used in a small number of cases, there is much to show that it also fails to secure the destruction of the hailstorm.

In a review of this report, presented to the Minister of Public Instruction for France, by Prof. Alfred Angot, of the Central Meteorological Office in Paris, he says:

If the question of the efficiency of cannonading against hail has not been settled, still the conference at Gratz has certainly attained progress in the study. The technical details of the shooting were made the object of profound discussion, and precise rules were adopted for the organization of controlled stations, where the shooting, done in a systematic manner, will be accompanied by complete observations of all the details of the thunderstorms. This is the only scientific manner of deciding whether the cannonading is really effective, and, if so, how it produces its effect and upon what meteorological element it is capable of acting. One may add, furthermore, that the general impression resulting from these discussions is far from being favorable to the cannonading. The doubt and skepticism that men of science have shown from the beginning have not been diminished, but seem rather to have gained headway, replacing the immoderate enthusiasm of the early days in the minds of many practical men and vineyardists.

HORIZONTAL CURVILINEAR MOVEMENT OF CLOUDS.

In 1872, the Editor had occasion to urge that more attention be paid to the most careful observation of the direction and apparent velocity of the clouds. Several forms of nephoscope were devised and constructed; among them was one that may be called the "vanishing point nephoscope," which is described on pages 333–334 of the Editor's "Treatise on meteorological apparatus and methods" (see part 2, Report of the Chief Signal Officer, 1887). In this apparatus a graduated semicircle can be set at any azimuth and altitude so that the movement of the cloud, if it move in a straight line, must lie in the plane of this semicircle. In such a case, therefore, the horizontal diameter of the semicircle gives us at once the location of the vanishing points from which and toward which the cloud is moving, if its motion is horizontal. With this apparatus one can in a few minutes determine the average direction of motion of clouds in all parts of the sky, and, as stated on page 334 of the "Treatise," it was frequently observed:

* * * that clouds belonging apparently to the same stratum have a perceptibly different direction of motion in different parts of the sky. This diversity of directions has sometimes been explicable by ascending motions in different parts of the surrounding region. At other times this variation has been explicable by the assumption that clouds in different portions of the sky are not moving in precisely parallel rectilinear directions, but presumably in circles about some neighboring storm center.

The latter assumption was that which most frequently seemed reasonable, and we do not see but that the same explanation applies to the observations made at Montsouris and Paris, as described by Besson on a previous page of this number of the MONTHLY WEATHER REVIEW.

THE SCOTTISH ANTARCTIC EXPEDITION.

We print herewith the last communication received from the Scottish Antarctic Expedition:

STANLEY, FALKLANDS,
ANTARCTIC SHIP SCOTIA, *January 24, 1903.*

DEAR SIR: I beg to acknowledge, with thanks, receipt of your esteemed favor of November 6 last and the copies of the MONTHLY WEATHER REVIEW. Please convey to the Chief of Bureau my best thanks for his gift. We leave here to-morrow for the Weddell Sea,[1] pushing south along the thirtieth parallel of west longitude and wintering in the ice. We do not expect to return here before February or March of next year. I hope to be able to contribute something to your magazine. We shall concentrate on kite work as much as circumstances permit, and have a complete outfit of meteorographs, kites, etc., on board. There is, we believe, some possibility of the ink freezing, as we have not the new ink, containing tonsol, on board.

(Signed) R. C. MOSSMAN,
Meteorologist.

THE CLIMATES OF GEOLOGICAL AGES.

One of the most interesting branches of climatological study consists in the effort to reason backward from the known climates of various portions of the world in the present epoch to what those climates must have been in earlier ages, when animals and plants differed somewhat from those of to-day. This study involves quite as much geology as meteorology, and is not likely to be solved without a due regard to both these elements. The latest contribution consists in a broad treatment of the subject by Professor Dr. Fritz Frech, of Breslau, who has considered the geological and paleontological conditions that must be satisfied, and shows plainly how our present ignorance of many points prevents logical argumentation on the subject. In conclusion he says:

It scarcely needs to be stated that I am far from considering the problem of the distribution of heat in past geological ages as solved by the present studies. Whoever has busied himself for many years with the reconstruction of the ancient oceans and continents will best know how great are the gaps in our knowledge of this subject and what surprises are in store for us; for instance, as the results of that research in the antarctic regions which is just now beginning. I have discussed the purely physical side of the problem and can easily imagine that further modifications are possible; that, for instance, there exist still other relations between the enormous eruptions of masses that sometimes cover whole continents and the changes in the cilmatic temperature. But I consider it certain that there is a parallelism between the maxima of terrestrial temperatures and the maxima of volcanic activity, and that there is a simultaneity between the glacial epochs and the minima of eruptive activity. The general conclusions are as follows:

1. The question as to the origin of the prevailing warmer climates in the geological past can not be separated from the problem of the glacial epochs.

2. The variations in the percentage of carbonic acid gas in the atmosphere afford the physical explanation for the differences of the warmer and colder climates in the geological past; a higher percentage of carbonic acid gas corresponds to a higher temperature.

3. Since carbonic acid gas is consumed by organic and chemical processes, therefore, volcanic exhalations constitute the only source to counterbalance this consumption.

4. Consequently, through all geological time a diminution of eruptive activity corresponds to a diminution of carbonic acid gas and a fall of temperature; such a fall of temperature twice produced a glacial epoch; namely, at the end of the paleozoic epoch and at the beginning of the present geological epoch. Every maximum of volcanic eruptions corresponds to a clearly observable rise in temperature.

5. Independent of this factor, that influences the climate of the whole earth, are the distribution of land and water, as also the consequent direction of the currents of wind and ocean, which are of great importance in determining the character of the climate.

6. On the other hand, the uniform warm climate that has prevailed during by far the greater number of geological periods can not be explained by any other distribution of the quantity of heat that we now receive.

7. All the older periods of the earth's history up to the end of the carboniferous found a warm climate fairly uniformly distributed over the earth.

8. After the close of the carboniferous period there occurred a glacial period that was principally developed in the Southern Hemisphere, but of which there are also indications in the Northern and which soon disappeared again.

9. After the consequences of this glacial epoch had been gradually overcome there again prevailed during the first two-thirds of the middle age of the earth, a uniformly tropical and subtropical climate in the central and upper dyas (or Permian strata.) From the upper Jura onwards, but especially in cretaceous times a division in the climatic zones was formed.

10. Two periods of the maximum of eruptions at the beginning and in the middle of the tertiary epoch correspond again to maxima of temperature.

11. The diminution of eruptions in the last portion of the tertiary epoch runs parallel with the diminution of heat; the glacial epoch (precisely as in the case of the paleozoic cold period) is to be recognized by an almost perfect cessation of eruptive activity, but the present epoch, by a renewed activity.

[1] The southern extremity of the South Atlantic, explored by Captain Weddell about 1820.

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR JANUARY.

During January, 1903, the temperature was normal in the lower Lake region; slightly below in the South Atlantic States, east Gulf States, the Ohio Valley and Tennessee, and the middle Pacific district; elsewhere it was above normal, and in the majority of these districts the mean daily excess was much more marked than in the regions where the departures showed a deficiency.

The precipitation was considerably above normal in the Florida Peninsula, and slightly above in North Dakota, the middle Plateau region, and the middle Pacific district; elsewhere it was below normal, the departures, however, amounted to less than 1 inch, except in the Ohio Valley and Tennessee where it was —1.9 inches.

The relative humidity was normal in the Middle Atlantic, South Atlantic, and west Gulf States, the Ohio Valley and Tennessee, upper Lake region, and the north Pacific district; slightly below in New England, the east Gulf States, North Dakota, the southern Plateau region, and the south Pacific district, and slightly above normal in the remaining geographical districts.

The cloudiness was slightly below the average in New England, the Missouri Valley and middle Plateau region, and above the average in the remaining districts. the departures, however, not being very marked, except in the Florida Peninsula, and the north Pacific, and middle Pacific districts.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart VI and the numerical values are given in Tables I and VI.

The area of highest mean atmospheric pressure overlay the northern and middle Plateau regions, and northern and west-central California. Another area of somewhat lower mean pressure overlay the central Gulf States, and south-central Tennessee. The lowest means were in northern New England. The pressure was slightly above normal in the Rio Grande Valley and thence northwestward to southeastern Washington and the California coast; elsewhere it was below normal, and over the greater portion of the area of deficient pressure the departures were quite decided and were most marked in parts of the Lake region.

The mean pressure for January, 1903, increased slightly over that of December, 1902, generally west of the one hundred and fifteenth meridian. To the eastward of said meridian it

decreased, and generally with marked changes, the greatest minus departures being reported from the northern districts to the eastward of Montana.

TEMPERATURE OF THE AIR.

The mean temperature was below the normal from southwestern Pennsylvania, Lake Erie, southern Michigan, and Indiana, southward over the South Atlantic States to the Atlantic Ocean, and over the Ohio Valley and Tennessee, and east Gulf States to the Gulf of Mexico; also along the eastern and central coasts of the west Gulf States, in the northern part of the great valley of California, and on the coast of central California; elsewhere it was above normal, with very decided departures in the Missouri Valley, North Dakota, and northern slope, the departures in Montana showing a mean daily excess of 11.9° at Helena and 13.4° at Miles City. The data compiled at Climate and Crop centers from regular Weather Bureau and cooperating stations combined show a slightly greater area of deficient temperature, and the location somewhat modified; also that the amount of excess was not so great for the various States taken as a whole as when the individual stations within the State were considered. Several Montana stations report the highest January mean temperature since the establishment of the stations.

The isotherms of maximum temperature were located somewhat to the northward of their positions in January, 1902, particularly that of 80° over Florida and the west Gulf States. The area embraced within the isotherm of zero temperature, or lower, is not so extensive as it was in January, 1902. Freezing temperatures were not reported from a narrow strip along the littoral of Texas, and in parts of extreme southern and east-central and west-central Florida.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	25.9	+0.9		
Middle Atlantic	12	32.8	+0.3		
South Atlantic	10	46.5	−1.1		
Florida Peninsula*	8	59.9	+0.1		
East Gulf	9	47.5	−1.3		
West Gulf	7	48.1	+1.5		
Ohio Valley and Tennessee	11	33.9	−0.3		
Lower Lake	8	25.3	0.0		
Upper Lake	10	19.5	+2.0		
North Dakota*	8	11.4	+6.1		
Upper Mississippi Valley	11	24.8	+3.7		
Missouri Valley	11	25.7	+5.7		
Northern Slope	7	26.4	+8.9		
Middle Slope	6	34.4	+5.3		
Southern Slope*	6	40.9	+2.4		
Southern Plateau*	13	38.5	+2.7		
Middle Plateau*	9	26.4	+1.5		
Northern Plateau*	12	31.0	+5.8		
North Pacific	7	42.6	+3.2		
Middle Pacific	5	46.8	−0.2		
South Pacific	4	53.1	+2.5		

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

The mean temperature of the month was higher than the average over very nearly the entire Dominion, the only districts where a negative departure was registered being the extreme southwest counties of Ontario, and in far northern regions near Hudson's Bay, and in Athabasca, Yukon, and Cassair. The largest positive departures, between 9° and 12°, occurred in Assiniboia; westward from this territory the departure diminished to 3° at Vancouver, and eastward to 3° at Lake Superior, whence across Ontario, Quebec, and the Maritime Provinces it ranged from average to 2° above, except near Lake Erie and in the upper Ottawa Valley where it was about 1° below.

PRECIPITATION.

Data tabulated from reports from regular Weather Bureau stations show the precipitation to have been below the normal, except in parts of the lower Lake region, New England, the Middle Atlantic, South Atlantic, Gulf States, North Dakota, and in the upper Rio Grande Valley, and from northern Utah and southwestern Idaho westward to the Pacific. The greatest excess occurred on the northwestern coast of California. Deficiencies ranging from 1 inch to 4 inches obtained in the eastern part of the west Gulf States, northern part of the east Gulf States, the Ohio Valley and Tennessee, the upper Lake region, and central Mississippi Valley. The greatest monthly amounts of precipitation occurred in the Pacific districts north of central California. Relatively large amounts are also reported from the Florida Peninsula.

The southern limit of snow on ground at the end of the month was located much farther to the northward than at the end of January, 1902, except over the Plateau and western parts of the slope regions where it was about the same, and on the Pacific coast where it extended to the southern border of Oregon.

The snow conditions in the western mountains are generally very satisfactory, and a good and ample flow of water for irrigation purposes seems to be assured for the coming crop season. During the latter part of the month the snowfall in Nevada was the heaviest since 1890, as it also was over the great Salt Lake watershed in Utah. The snowfall was deficient in the Upper Peninsula of Michigan.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	3.65	92	−0.3	
Middle Atlantic	12	3.38	92	−0.2	
South Atlantic	10	3.80	90	−0.4	
Florida Peninsula*	8	5.58	194	+2.7	
East Gulf	9	4.28	81	−1.0	
West Gulf	7	2.59	74	−0.9	
Ohio Valley and Tennessee	11	2.28	55	−1.9	
Lower Lake	8	2.25	85	−0.4	
Upper Lake	10	1.19	60	−0.8	
North Dakota*	8	0.78	134	+0.2	
Upper Mississippi Valley	11	0.92	51	−0.9	
Missouri Valley	11	0.48	49	−0.5	
Northern Slope	7	0.31	51	−0.3	
Middle Slope	6	0.18	23	−0.6	
Southern Slope*	6	0.44	47	−0.5	
Southern Plateau*	13	0.35	30	−0.8	
Middle Plateau*	8	1.30	108	+0.1	
Northern Plateau*	12	1.76	81	−0.4	
North Pacific	7	8.34	94	−0.5	
Middle Pacific	5	5.65	106	+0.3	
South Pacific	4	2.08	78	−0.6	

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The precipitation did not differ much from average anywhere except perhaps very locally, and this more especially in Ontario where there were instances of positive and negative departures at stations not far distant from each other. In the eastern and northern portions of the Northwest Territories the snowfall was rather in excess of the average, but west and south it was deficient. At the close of the month snow lay to a depth of from three to five feet over the more eastern portions of Quebec, but southward over the Maritime Provinces the depth diminished to a light covering near the Bay of Fundy, and to none in western Nova Scotia; westward the depth diminished from 34 inches at Quebec to 15 at Montreal, and then to almost nil at Kingston and near the shores of Ontario and Erie, with a moderate covering over the inland counties of Ontario. In Saskatchewan and northern Alberta the depth was between 12 and 18 inches, and less farther south.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 16, 17. Arkansas, 27. California, 26, 27, 28, 30, 31. Florida, 17, 26, 28. Idaho, 25. Indian Territory, 7, 26. Kentucky, 10, 29. Maryland, 11, 20, 24. Massachusetts, 2, 3, 11, 30. New York, 11, 28, 30. North Carolina, 6, 10, 11, 20, 21, 24.

Ohio, 11. Oregon, 8, 18, 19, 24, 25, 26, 27, 28, 29, 30, 31. Pennsylvania, 2, 3, 11, 20, 29. Rhode Island, 7, 11, 30. South Carolina, 7. Texas, 20. Utah, 10, 18, 22, 25, 28. Virginia, 4, 11, 20, 24. Washington, 8, 18, 19, 24, 25. West Virginia, 11. Wyoming, 28.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 10, 13, 14. Arizona, 17. Arkansas, 10, 11, 19, 20, 24. California, 15, 26, 27, 28, 29, 30, 31. Colorado, 4, 28. Connecticut, 2, 11, 21. Delaware, 4. District of Columbia, 11. Georgia, 6, 10, 12, 14, 20, 22. Idaho, 1, 3, 17, 21, 22, 23. Illinois, 2, 10, 11, 20, 23, 24, 27. Indiana, 2, 3, 4, 6, 7, 10, 11, 21, 23, 31. Indian Territory, 10, 31. Iowa, 2, 3, 25, 26, 27, 28. Kansas, 10, 16, 20, 22, 23, 28. Kentucky, 3, 7, 10, 11, 12, 20. Louisiana, 13, 14. Maine, 3, 21, 30. Maryland, 2, 4, 7, 11, 20, 21, 30. Massachusetts, 2, 3, 11, 21. Michigan, 2, 3, 4, 15, 26, 29. Minnesota, 6, 26, 27, 28. Mississippi, 10, 13, 14, 27. Missouri, 1, 2, 4, 10, 11, 21, 22, 23, 24, 29, 31. Montana, 18, 20, 21, 25. Nebraska, 25, 27, 28. Nevada, 21, 23, 25, 27. New Hampshire, 3, 11, 21, 29. New Jersey, 3, 11, 21, 27, 29, 30. New Mexico, 16. New York, 2, 3, 11, 15, 20, 21, 28, 29, 31. North Carolina, 10, 11, 19, 20, 21, 24, 27. North Dakota, 3, 6, 13, 21, 25. Ohio, 2, 6, 7, 11, 21, 31. Oklahoma, 9, 10, 19, 20, 23. Oregon, 26, 27, 28, 30, 31. Pennsylvania, 2, 3, 5, 11, 12, 15, 17, 20, 21, 30. Rhode Island, 11, 30. South Carolina, 6, 10, 11, 14, 19, 20, 21, 22. South Dakota, 3, 26, 27, 28. Tennessee, 4, 5, 8, 10, 11, 16, 17, 19, 20. Texas, 13, 15, 20. Utah, 1, 11, 21, 22, 24, 25, 26, 27, 28, 30, 31. Vermont, 3, 21. Virginia, 4, 7, 10, 11, 12, 20, 21, 24. Washington, 8, 12, 18, 20, 24, 25, 26, 27, 28, 29, 31. West Virginia, 1, 2, 10, 11, 12, 20, 21, 22, 23, 25. Wisconsin, 26, 27, 28, 29. Wyoming, 22, 25, 26.

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	74	— 2	Missouri Valley	79	+ 1
Middle Atlantic	75	0	Northern Slope	74	+ 4
South Atlantic	78	0	Middle Slope	68	+ 1
Florida Peninsula	84	+ 2	Southern Slope	66	+ 2
East Gulf	77	— 1	Southern Plateau	47	— 4
West Gulf	75	0	Middle Plateau	71	+ 2
Ohio Valley and Tennessee	77	0	Northern Plateau	84	+ 3
Lower Lake	82	+ 1	North Pacific	87	0
Upper Lake	82	0	Middle Pacific	86	+ 5
North Dakota	78	— 3	South Pacific	71	— 3
Upper Mississippi Valley	80	+ 2			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 372 thunderstorms were received during the current month as against 104 in 1902 and 386 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 29th, 76; 27th, 54; 26th, 52.

Reports were most numerous from: Florida, 54; New York, 46; Louisiana, 39.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 9th to 17th.

In Canada: Thunderstorms were reported from Ottawa, 17; Toronto, 29; Port Stanley, 29. An aurora was observed at Battleford on the 5th.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.5	— 0.3	Missouri Valley	5.0	— 0.1
Middle Atlantic	6.1	+ 0.5	Northern Slope	4.8	+ 0.2
South Atlantic	6.0	+ 0.7	Middle Slope	4.6	+ 0.8
Florida Peninsula	6.4	+ 1.7	Southern Slope	4.4	+ 0.6
East Gulf	6.2	+ 0.6	Southern Plateau	3.4	+ 0.5
West Gulf	5.2	+ 0.8	Middle Plateau	4.6	— 0.2
Ohio Valley and Tennessee	6.6	+ 0.2	Northern Plateau	7.8	+ 0.5
Lower Lake	7.8	+ 0.3	North Pacific	8.2	+ 1.1
Upper Lake	7.0	+ 0.2	Middle Pacific	6.4	+ 1.3
North Dakota	5.3	+ 0.6	South Pacific	4.6	+ 0.5
Upper Mississippi Valley	5.8	+ 0.5			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Bismarck, N. Dak	6	63	nw.	North Head, Wash	1	60	s.
Block Island, R. I	12	55	w.	Do	2	58	s.
Do	18	50	nw.	Do	18	68	se.
Do	30	52	w.	Do	20	52	se.
Do	31	56	w.	Do	23	50	se.
Buffalo, N. Y	12	56	w.	Do	24	51	nw.
Do	15	53	w.	Do	29	84	se.
Do	30	64	w.	Omaha, Nebr	7	52	nw.
Carson City, Nev	24	56	sw.	Point Reyes Light, Cal	24	50	sw.
Do	25	60	sw.	Do	25	59	nw.
Do	26	63	sw.	Do	26	54	s.
Do	27	50	sw.	Do	27	72	s.
Cheyenne, Wyo	6	55	nw.	Do	30	58	s.
Cleveland, Ohio	7	54	nw.	Do	31	50	nw.
Do	30	54	w.	St. Louis, Mo	7	52	w.
Columbus, Ohio	29	50	w.	Sioux City, Iowa	6	72	nw.
Do	30	60	w.	Do	7	65	nw.
Duluth, Minn	7	51	nw.	Syracuse, N. Y	11	64	s.
Fort Smith, Ark	7	50	nw.	Do	30	50	sw.
Hannibal, Mo	7	52	nw.	Tatoosh Island, Wash	6	71	e.
Harrisburg, Pa	30	53	w.	Do	7	72	e.
Hatteras, N. C	8	60	w.	Do	10	52	e.
Huron, S. D	6	72	nw.	Do	13	50	ne.
Do	7	52	nw.	Do	18	50	s.
Independence, Cal	25	75	w.	Do	19	50	sw.
Jacksonville, Fla	7	57	sw.	Do	20	62	s.
Lincoln, Nebr	6	60	nw.	Do	23	64	sw.
Do	7	58	nw.	Do	24	64	w.
Mount Tamalpais, Cal	18	51	nw.	Do	25	50	nw.
Do	24	57	sw.	Do	29	52	sw.
Do	25	86	nw.	Valentine, Nebr	6	57	nw.
Do	26	57	s.	Do	7	60	nw.
Do	27	51	sw.	Williston, N. Dak	6	66	nw.
New York, N. Y	3	56	w.	Do	19	50	nw.
Do	12	62	w.	Winnemucca, Nev	26	61	sw.
Do	30	60	w.	Yankton, S. Dak	6	50	nw.
Do	31	52	w.	Do	7	50	nw.

DESCRIPTION OF TABLES AND CHARTS.

By W. B. STOCKMAN, Forecast Official, in charge of Divison of Meteorological Records.

For description of tables and charts see page 582 of REVIEW for December, 1902.

TABLE 1.—*Climatological data for Weather Bureau Stations, January, 1903.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							35.9	+ 0.9										74	3.65	— 0.3								5.6	
Eastport	76	69	74	29.72	29.81	— .19	31.2	+ 0.8	45	21	28	—14	19	14	40	19	16	83	3.85	— 0.1	12	9,646	w.	40	s.	12	9	12	10	5.7	12.1
Portland, Me.	103	81	117	29.74	29.87	— .18	23.0	+ 0.5	48	1	30	— 9	19	16	35	20	14	71	4.90	+ 1.3	9	7,096	sw.	36	w.	31	15	8	8	4.4	12.3
Concord	298	70	79	29.56	29.90	— .15	21.8	+ 0.8	48	1	30	—15	20	13	42				3.61	+ 0.3	11	4,631	nw.	33	w.	31	11	10	10	5.4	10.2
Northfield	876	16	60	28.91	29.90	— .15	16.6	+ 1.1	44	1	27	—19	20	6	41	14	10	76	2.21	— 0.5	12	6,128	s.	36	sw.	12	4	14	13	6.5	17.7
Boston	125	115	181	29.76	29.91	— .14	28.6	+ 1.6	50	1	36	— 1	19	21	33	26	20	69	3.43	— 0.7	10	9,280	w.	48	e.	3	14	4	13	5.4	4.2
Nantucket	12	43	85	29.90	29.91	— .13	31.6	+ 0.2	52	21	38	4	19	26	27	29	25	76	3.02	— 0.7	14	12,403	w.	49	se.	3	8	8	15	6.5	10.9
Block Island	31	11	60	29.91	29.95	— .12	31.4	+ 0.3	51	21	38	5	19	25	32	29	24	74	4.42	+ 0.2	10	15,248	w.	56	w.	31	13	8	10	5.1	3.6
Narragansett							29.6	+ 0.8	50	*	38	1	19	21	35				4.27	— 1.1	9		w.				13	7	11		14.5
New Haven	106	117	140	29.83	29.95	— .13	29.2	+ 1.7	49	2	37	4	19	22	33	26	20	71	3.17	— 1.1	10	7,575	n.	38	w.	31	15	6	10	4.7	8.3
Mid. Atlantic States.							32.8	+ 0.3										75	3.38	— 0.2								6.1	
Albany	97	102	115	29.84	29.95	— .12	24.2	+ 1.0	43	29	32	— 4	19	17	33	22	19	83	1.83	— 1.1	11	5,377	s.	27	w.	31	5	8	18	7.1	4.8
Binghamton	875	79	99	28.98	29.94	— .14	24.3	+ 1.9	48	30	32	0	24	17	33				2.41	— 0.5	15	5,734	w.	31	w.	30	4	9	18	7.2	16.3
New York	314	108	350	29.62	29.97	— .13	30.6	+ 0.1	51	28	37	8	13	24	28	28	22	72	3.44	— 0.6	12	12,958	w.	62	w.	12	8	9	14	6.1	5.9
Harrisburg	374	94	104	29.59	30.01	— .09	28.6	— 1.7	46	28	35	6	13	22	30	26	21	75	3.67	0.0	10	6,511	w.	53	w.	30	6	8	17	6.9	12.1
Philadelphia	117	168	184	29.87	30.01	— .10	32.6	+ 0.6	52	30	39	10	13	26	26	29	24	73	3.52	+ 0.1	12	8,115	w.	36	nw.	30	9	10	12	5.7	3.9
Scranton	805	111	119	29.08	29.97	— .12	26.6	.....	49	29	34	4	13	19	29	24	18	69	2.73	.....	13	6,521	sw.	38	w.	30	4	7	20	7.5	5.2
Atlantic City	52	39	48	29.94	30.01	— .10	33.6	+ 1.1	57	28	41	10	13	26	27	30	26	77	3.93	+ 0.1	11	6,876	nw.	34	sw.	11	9	13	9	5.1	6.9
Cape May	17	47	51	30.02	30.03	— .09	34.6	+ 0.2	55	3	41	14	19	28	27	32			4.45	+ 0.6	11	7,231	nw.	34	w.	12	8	11	12	5.8	4.0
Baltimore	123	69	117	29.87	30.01	— .11	33.6	— 0.4	57	28	40	12	13	27	25	29	24	70	3.81	+ 0.5	12	6,410	w.	42	w.	30	10	10	11	5.7	6.8
Washington	112	59	76	29.90	30.03	— .10	33.4	+ 0.2	58	28	41	11	13	26	26	30	25	75	4.26	+ 0.8	13	5,555	nw.	36	nw.	30	10	5	16	6.1	2.2
Cape Henry	18	5	58	30.00	30.02	— .11	40.6	+ 0.4	66	3	48	20	9	34	25				1.93	— 2.3	12	10,541	sw.	42	nw.	8	7	10	14	6.3	
Lynchburg	681	83	88	29.26	30.02	— .11	36.6	— 0.2	65	28	45	15	13	28	30	32	28	75	5.31	+ 1.4	13	3,795	w.	26	nw.	9	10	11	10	5.3	1.6
Norfolk	91	102	111	29.93	30.03	— .10	41.2	+ 0.8	66	3	49	20	13	33	28	37	33	76	1.94	— 1.9	11	7,300	w.	37	s.	11	8	11	12	5.7	T.
Richmond	144	82	90	29.88	30.05	— .08	38.2	.....	64	28	46	17	13	30	25				3.61	.....	11	4,551	w.	25	w.	30	8	12	11	5.8	0.9
Wytheville	2,293	40	47	27.57	30.03	— .11	32.2	.....	62	29	40	8	9	24	31	28	26	84	3.21	.....	13	5,572	w.	32	w.	30	10	7	14	5.7	8.4
S. Atlantic States.							46.5	— 1.1										78	3.80	— 0.4								6.0	
Asheville	2,235	73	100	27.65	30.04	— .11	36.4	.....	63	29	45	11	13	27	35	32	28	78	1.61	.....	10	7,704	n.	44	n.	30	11	8	12	5.4	0.8
Charlotte	773	68	76	29.19	30.05	— .10	39.8	— 1.4	66	29	47	18	13	32	26	35	30	72	3.10	— 2.0	11	5,734	sw.	33	nw.	8	10	7	14	6.1	
Hatteras	11	12	47	30.02	30.03	— .11	45.7	0.0	67	*	51	24	13	40	30	43	41	88	2.60	— 3.3	12	11,728	w.	60	w.	8	12	6	13	5.4	
Kittyhawk							42.5	+ 0.1	66	29	48	22	13	37	24				6.07	+ 0.9	11	10,093	sw.				14	8	9	4.6	
Raleigh	376	93	101	29.62	30.05	— .08	40.6	— 0.2	67	29	50	18	9	32	30	36	31	73	3.04	— 0.6	11	5,026	w.	33	nw.	30	9	9	13	6.1	
Wilmington	78	82	99	29.95	30.03	— .11	46.2	— 0.7	70	30	55	22	9	37	28	41	37	76	3.43	— 0.5	12	6,395	w.	38	nw.	30	7	14	10	5.9	
Charleston	48	14	92	30.02	30.07	— .08	48.5	— 1.5	74	29	56	28	13	41	26	44	42	83	5.17	+ 1.2	14	7,749	w.	35	nw.	30	2	17	12	6.5	
Columbia	351	114	122	29.68	30.07	— .08	44.0	— 1.6	70	29	52	21	13	36	28	40	36	78	3.06	— 0.7	11	6,877	sw.	38	sw.	7	7	9	15	6.5	
Augusta	180	89	97	29.88	30.07	— .09	44.8	— 1.8	71	29	53	22	13	37	30	40	35	73	3.41	— 1.1	12	5,113	w.	30	nw.	30	12	8	11	5.6	
Savannah	65	79	89	30.00	30.07	— .08	49.8	— 1.2	78	29	58	27	13	42	33	44	40	76	3.64	+ 0.4	11	5,906	w.	34	w.	7	5	11	15	6.7	
Jacksonville	43	101	129	30.01	30.06	— .09	52.8	— 2.4	78	29	60	28	13	45	27	48	44	79	4.44	+ 1.2	14	7,135	ne.	57	sw.	7	7	4	20	7.2	
Florida Peninsula.							63.3	+ 0.6										84	5.37	+ 2.7								6.4	
Jupiter	28	10	48	30.02	30.05	— .05	66.6	+ 0.9	81	2	73	37	9	60	25	62	59	84	6.94	+ 3.1	15	7,402	nw.	36	s.	11	5	19	7	5.6	
Key West	22	43	50	30.03	30.05	— .05	69.2	— 0.5	80	26	74	54	9	65	17	65	64	85	3.43	+ 1.3	11	7,759	ne.	40	nw.	6	6	8	17	6.9	
Tampa	34	60	67	30.03	30.07	— .05	60.0	+ 1.3	80	27	68	33	13	52	27	55	53	84	6.33	+ 3.6	13	4,892	ne.	36	w.	6	7	8	16	6.8	
East Gulf States.							47.5	— 1.3										77	4.28	— 1.0								6.2	
Atlanta	1,174	190	216	28.81	30.07	— .08	41.6	— 0.9	69	29	48	18	13	35	28	36	32	74	1.96	— 3.8	12	10,412	nw.	48	nw.	30	7	8	16	6.5	T.
Macon	370	93	99	29.68	30.08	— .08	45.0	.....	70	29	53	22	13	37	31				2.88	.....	13	5,229	nw.	34	nw.	30	7	3	21	7.0	
Pensacola	56	79	96	30.03	30.10	— .04	50.6	— 1.9	66	29	57	27	13	44	22				6.37	+ 1.7	15	7,648	ne.	48	sw.	11	9	6	16	6.1	
Mobile	57	88	96	30.03	30.10	— .05	49.2	— 1.3	74	29	56	25	13	42	26	45	41	77	5.39	+ 0.3	13	5,591	n.	35	n.	30	9	5	17	6.4	
Montgomery	223	100	112	29.85	30.09	— .07	46.4	— 1.9	76	29	54	24	13	39	27	42	37	76	3.16	— 2.2	11	5,536	e.	34	w.	7	11	6	14	5.7	
Meridian	375	84	93	29.68	30.10	— .06	45.4	— 1.6	76	29	54	20	13	37	33				4.90	— 0.2	13	4,748	nw.	34	w.	7	9	5	17	6.3	T.
Vicksburg	247	62	74	29.78	30.04	— .11	47.4	+ 0.1	76	29	56	24	12	39	30	43	38	77	4.10	— 1.4	13	6,011	nw.	34	nw.	8	7	15	9	5.5	
New Orleans	51	88	121	30.03	30.10	— .03	52.0	— 1.8	77	29	59	31	13	45	28	47	43	79	4.01	— 1.2	13	6,915	ne.	32	se.	10	8	9	14	6.0	
West Gulf States.							43.1	+ 1.5										75	3.59	— 0.9								5.2	
Shreveport	249	77	84	29.82	30.10	— .04	46.8	+ 0.9	80	29	55	24	12	39	34	42	36	72	2.95	— 1.6	9	5,387	se.	31	nw.	29	14	5	12	5.1	
Fort Smith	457	79	94	29.56	30.06	— .08	40.6	+ 4.5	72	28	49	16	12	32	31	36	31	72	1.52	— 0.8	9	6,682	e.	50	nw.	7	6	14	11	5.9	0.5
Little Rock	357	93	100	29.70	30.08	— .07	42.5	+ 1.7	75	29	50	17	12	35	28	37	31	69	2.60	— 2.3	10	6,043	nw.	40	nw.	29	10	10	11	5.2	
Corpus Christi	20	48	53	30.07	30.08	— .02	55.6	+ 0.1	81	28	63	35	12	48	30	50	47	79	1.16	— 1.7	9	7,426	s.	30	n.	30	16	6	9	4.4	
Fort Worth	670	106	114	29.37	30.10	— .02	46.0	.....	85	28	55	18	12	37	35				1.83	.....	10	8,068	s.	38	w.	23	13	6	12	5.7	
Galveston	54	106	112	30.01	30.07	— .06	52.2	— 0.5	70	29	57	34	12	47	20	49	47	85	4.55	+ 0.9	10	8,887	nw.	36	n.	30	11	5	15	5.3	
Palestine	510	73	79	29.55	30.10	— .02	47.8	+ 4.0	81	29	56	23	12	40	31	43	39	77	2.96	— 1.4	13	5,993	nw.	28	n.	29	9	9	13	6.1	
San Antonio	701	80	91	29.34	30.08	— .02	51.4	— 0.1	81	29	61	27	12	42	32	45	40	72	2.39	+ 0.7	11	5,443	n.	36	n.	29	13	9	9	4.5	
Taylor	583	55	63	29.46	30.09	— .02	48.8	.....	82	29	58	23	12	40	36				1.84	.....	11	6,747	n.	35	n.	29	13	8	10	4.7	
Ohio Val. and Tenn.							33.9	— 0.3										77	2.28	— 1.8								6.6	
Chattanooga	762	106	112	29.27	30.11	— .05	39.6	— 1.4	73	29	47	16	13	32	33	35	29	70	2.16	— 4.0	12	5,588	nw.	36	w.	7	9	8	14	6.1	0.2
Knoxville	1,004	10	88	28.99	30.07	— .08	37.4	— 0.3	72	29	45	12	13	30	31	33	30	80	2.10	— 3.4	13	6,045	sw.	40	w.	7	7	4	20	6.8	0.1
Memphis	397	140	154	29.65	30.09	— .07	42.0	+ 2.1	73	29	49	18	12	35	26	37	32	70	3.31	— 2.2	12	8,617	nw.	47	nw.	7	13	5	13	5.4	T.
Nashville	546	122	131	29.49	30.09	— .07	38.6	+ 0.4	74	29	46	15	12	31	30	35	30	73	1.80	— 3.3	8	5,757	nw.	32	nw.	30	10	9	12	5.8	0.1
Lexington	989	75	102	28.94	30.05	— .08	32.1	— 1.0	67	29	39	4	12	25	30				1.68	— 2.1	14	9,711	w.	42	w.	30	8	10	13	6.3	4.3
Louisville	525	114	136	29.46	30.06	— .08	33.6	— 0.5	67	29	41	3	12	26	33	30	26	75	2.43	— 1.6	12	6,863	sw.	39	w.	7	9	7	15	6.2	1.9
Evansville	431	72	82	29.55	30.04	— .10	33.2	.....	66	28	40	4	12	26	30				2.43	.....	9	6,396	w.	36	w.	7	9	6	16	6.3	2.0
Indianapolis	822	154	164	29.10	30.02	— .10	26.8	— 1.5	62	29	34	— 6	12	20	31	25	22	83	2.39	— 0.6	12	9,034	s.	38	sw.	7	9	5	17	6.6	9.8
Cincinnati	628	152	157	29.34	30.04	— .08	31.1	— 1.4	66	29	38	0	12	24	31	29	25	79	2.05	— 1.4	13	6,843	sw.	36	w.	29	9	6	16	6.5	5.5
Columbus	824	87	100	29.10	30.01	— .10	28.3	— 0.1	61	29	36	— 3	12	21	30	26	24	84	2.11	— 1.2	13	10,204	sw.	60	w.	30	6	9	16	6.9	6.7
Pittsburg	842	116	123	29.07	30.00	— .11	30.6	0.0	64	29	38	2	13	24	27	28	23	74	2.33	— 0.8	15	5,899	nw.	30	nw.	30	3	10	18	7.5	6.1
Parkersburg	638	77	84	29.34	30.04	— .08	33.0	0.0	73	29	40	6	13	26	28	30	27	82	2.77	— 0.7	18	5,140	w.	32	nw.	30	4	9	18	7.6	3.8
Elkins	1,940	41	50	27.90	30.01	— .11	29.9	.....	68	29	39	3	12	21	38	26	23	80	3.79	.....	18	4,689	w.	34	s.	11	0	15	16	7.7	9.9
Lower Lake Region.							35.3	0.0										82	2.35	— 0.4								7.8	
Buffalo	767	178	206	29.06	29.91	— .16	26.2	+ 1.8	52	29	32	2	24	20	21	24	21	78	4.23	+ 1.2	27	13,702	w.	64	w.	30	2	3	26	8.7	33.0
Oswego	335	76	91	29.53	29.91	— .16	23.5	— 0.8	46	30	30	— 8	19	16	29	22	20	88	3.49	+ 0.5	23	10,958	s.	42	w.	30	2	5	24	8.2	27.9
Rochester	523	81	90	29.33	29.91	— .16	25.6	+ 1.7	50	29	32	2	9	20	28	23	19	80	2.54	— 0.6	21	8,559	sw.	45	w.	30	2	8	21	7.8	18.1
Syracuse	597	97	113	29.27	29.94	— .13	24.1	.....	48	30	31	— 6	19	17	30				3.41	.....	24	10,991	sw.	64	s.	11	3	8	20	7.4	24.0
Erie	713	92	102	29.15	29.94	— .14	26.5	— 0.4	58	29	33	— 1	12	20	27	25	22	83	1.49	— 1.8	20	10,545	w.				1	7	23	8.2	7.8
Cleveland	762	190	201	29.12	29.96	— .13	26.0	— 0.2	60	29	32	— 5	12	20	27	24	21	80	1.88	— 0.6	20	12,828	sw.	54	w.	30	2	7	22	8.0	14.8
Sandusky	629	62	70	29.26	29.97	— .12	25.8	— 0.7	59	29	32	— 5	12	20	26				1.62	— 0.6	16	6,823	sw.	34	w.	30	7	6	18	6.7	8.8
Toledo	628	123	127	29.26	29.96	— .13	25.0	— 1.1	58	29	32	— 7	12	18	25	23	20	81	1.10	— 1.0	14	8,465	sw.	38	w.	30	6	7	18	7.1	7.7
Detroit	730	153	193	29.12	29.94	— .14	24.1	— 0.4	53	29	30	— 5	12	18	19	23	21	87	1.63	— 0.3	18	9,342	w.	40	w.	30	2	9	20	7.8	12.7
Upper Lake Region.							19.5	+ 2.0										82	1.19	— 0.8								7.0	
Alpena	609	63	80	29.21	29.90	— .14	20.8	+ 2.7	43	1	27	— 1	8	15	25	20	17	84	1.52	— 1.0	7	8,309	w.	40	w.	30	2	5	24	8.3	6.2
Escanaba	612	43	57	29.22	29.92	— .13	17.1	+ 3.1	42	1	25	— 4	13	10	29	16	13	86	1.01	— 0.6	9	6,281	w.	27	nw.	7	6	13	12	6.3	9.1
Grand Haven	632	54	92	29.22	29.92	— .15	24.6	+ 0.4	48	29	30	— 7	12	19	23	21	88	1.66	— 1.0	18	9,996	se.	45	w.	30	4	6	21	7.8	15.5
Houghton	668	66	74	29.15	29.90	— .15	17.8	.....	38	26	24	— 3	19	12	25				2.54	.....	17	5,952	nw.	28	w.	14	1	7	23	8.4	23.3
Marquette	734	79	116	29.07	29.90	— .14	18.6	+ 2.6	42	1	24	— 1	19	13	21	16	11	72	1.35	— 0.7	12	9,335	w.	36	s.	19	2	12	17	7.7	13.3
Port Huron	638	70	120	29.23	29.95	— .11	22.7	+ 0.9	48	29	29	— 3	12	16	25	21	19	87	1.38	— 0.7	13	9,158	sw.	38	w.	30	5	9	17	7.3	8.7
Sault Ste. Marie	614	40	61	29.16	29.86	— .17	16.4	+ 2.1	37	1	24	— 9	8	9	28	15	10	80	1.46	— 0.3	16	6,801	e.	44	nw.	30	4	8	19	7.7	12.8
Chicago	823	241	274	29.06	29.96	— .14	24.0	+ 0.6	51	29	30	— 6	12	18	28	23	20	84	1.09	— 1.1	9	13,162	w.	46	w.	30	9	7	15	6.3	5.0
Milwaukee	681	124	142	29.20	29.96	— .12	22.3	+ 2.9	44	26	29	— 8	12	16	28	20	18	83	0.60	— 1.6	14	8,298	w.	30	w.	30	11	4	16	6.0	8.4
Green Bay	617	49	57	29.25	29.95	— .11	16.3	+ 2.1	40	26	24	—12	13	8	30	14	10	76	1.03	— 0.8	11	7,287	sw.	35	w.	30	10	7	14	6.2	12.5
Duluth	702	95	116	29.14	29.95	— .14	12.5	+ 2.1	36	26	21	—14	11	4	33	11	8	80	0.83	— 0.2	10	7,396	nw.	51	nw.	7	8	15	8	5.4	8.6

TABLE I.—*Climatological data for Weather Bureau Stations, January, 1903*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.				
North Dakota.							**11.7**	**+ 0.2**									**78**	**0.80**	**−0.2**									**5.3**	
Moorhead	935	54	60	28.94	30.02	−.12	9.0	+ 9.9	40	6	18	−22	30	0	43	8	7	93	1.18	−0.4	10	8,811	nw.	40	nw.	6	11	7	13	5.5	11.8
Bismarck	1,674	16	29	28.17	30.04	−.09	14.2	+ 9.7	50	6	25	−29	30	3	42	10	2	62	0.82	−0.3	6	7,680	nw.	63	nw.	6	15	8	8	4.9	8.2
Williston	1,885	14	44	27.91	29.98	−.13	11.9	+ 8.0	42	6	23	−21	29	1	45	10	6	78	0.40	−0.2	7	6,611	nw.	66	nw.	6	10	8	13	5.5	5.6
Upper Miss. Valley.							**24.8**	**+ 3.7**									**80**	**0.92**	**−0.9**									**5.8**	
Minneapolis	.....	99	208	.....	.....	.....	14.6	+ 2.7	40	31	24	−14	11	6	38	.....	.....	.....	0.22	−0.6	7	9,036	nw.	40	nw.	7	9	8	14	.....	4.2
St. Paul	837	102	122	29.02	29.98	−.13	15.0	+ 4.4	38	26	23	−13	11	6	36	13	10	82	0.27	−0.7	9	6,399	nw.	35	nw.	6	9	6	16	6.3	2.7
La Crosse	714	71	87	29.19	30.00	−.11	17.8	+ 3.1	43	31	26	−8	12	10	37	.....	.....	.....	0.20	−1.1	9	5,681	nw.	38	nw.	7	12	7	12	5.5	1.6
Davenport	606	71	79	29.31	29.98	−.14	24.9	+ 4.9	49	1	32	−2	12	18	28	22	20	84	0.79	−0.9	6	6,252	w.	34	w.	7	9	5	17	5.9	5.1
Des Moines	861	84	88	29.08	30.04	−.10	25.4	+ 7.9	49	31	34	−3	11	17	33	23	19	80	0.20	−1.1	5	6,511	nw.	48	nw.	7	12	6	13	5.7	1.4
Dubuque	698	100	117	29.20	29.99	−.13	22.4	+ 5.1	45	31	30	−5	12	15	27	19	16	78	0.17	−1.5	7	5,711	nw.	35	nw.	7	9	5	17	6.8	1.5
Keokuk	614	63	78	29.32	30.02	−.12	26.5	+ 3.3	51	26	33	−5	12	20	27	24	21	82	0.77	−1.0	10	6,476	sw.	40	nw.	7	12	5	14	5.2	8.0
Cairo	356	87	93	29.68	30.07	−.09	36.6	+ 1.9	70	29	44	10	12	30	35	33	29	78	2.35	−1.5	12	7,361	s.	35	nw.	7	10	7	14	5.6	2.4
Springfield, Ill.	644	82	93	29.31	30.02	−.11	27.2	+ 1.7	59	28	35	−6	12	20	29	25	22	85	1.44	−0.6	11	7,835	nw.	40	nw.	7	10	5	16	5.8	11.9
Hannibal	534	75	110	29.42	30.01	−.12	28.6	+ 2.7	61	28	36	−4	12	21	31	.....	.....	.....	1.98	−0.3	10	7,488	nw.	52	nw.	7	8	10	13	6.1	15.8
St. Louis	567	111	210	29.40	30.02	−.12	33.7	+ 3.2	64	26	41	3	12	27	31	30	25	73	1.76	−0.4	7	8,541	s.	52	w.	7	13	7	11	5.1	8.4
Missouri Valley.							**25.7**	**+ 5.7**									**79**	**0.48**	**−0.5**									**5.0**	
Columbia	784	11	84	29.16	30.03	−.10	30.6	0.0	66	28	39	−3	12	22	35	.....	.....	.....	1.90	−0.4	10	7,191	w.	47	nw.	7	12	7	12	5.3	10.2
Kansas City	963	78	95	29.00	30.07	−.08	31.6	+ 6.2	55	26	39	0	12	24	29	28	24	75	0.50	−0.7	5	6,971	nw.	41	nw.	7	10	11	10	5.1	4.6
Springfield, Mo	1,324	98	104	28.60	30.04	−.10	33.9	+ 1.6	65	28	42	2	12	26	36	30	27	80	1.32	−1.2	10	8,763	nw.	41	nw.	7	16	2	13	4.7	3.3
Topeka	.....	81	89	.....	.....	.....	31.2	+ 4.4	58	6	39	0	12	23	35	.....	.....	.....	0.44	−0.5	5	7,228	nw.	43	nw.	7	11	9	11	5.5	4.2
Lincoln	1,189	75	84	28.71	30.02	−.13	27.4	+ 9.7	53	15	36	−2	12	19	29	24	20	77	0.25	−0.4	4	8,465	nw.	60	nw.	6	17	7	7	3.9	2.6
Omaha	1,105	115	121	28.81	30.04	−.11	27.1	+ 7.9	51	15	35	−3	12	19	29	23	19	76	0.07	−0.6	5	7,316	nw.	52	nw.	7	9	12	10	5.2	0.4
Valentine	2,598	47	54	27.18	30.00	−.12	23.2	+ 6.3	51	25	35	−12	12	11	42	20	17	82	0.22	−0.4	4	8,584	nw.	60	nw.	7	19	8	4	3.3	2.2
Sioux City	1,135	96	164	28.76	30.04	−.11	22.8	+ 6.5	51	6	31	−6	12	14	37	.....	.....	.....	0.06	−0.6	4	9,310	nw.	72	nw.	6	11	7	13	5.3	0.7
Pierre	1,572	43	50	28.29	30.03	−.10	19.4	+ 6.7	50	6	28	−9	12	11	37	17	13	78	0.26	−0.2	6	5,521	se.	42	nw.	6	13	9	9	4.7	1.4
Huron	1,306	56	67	28.56	30.03	−.13	13.4	+ 6.4	45	6	24	−17	12	3	36	12	9	81	0.08	−0.4	5	9,187	nw.	72	nw.	6	12	11	8	5.0	0.8
Yankton	1,233	42	49	28.66	30.03	−.13	21.7	+ 7.5	49	6	31	−9	12	12	36	.....	.....	.....	0.17	−0.4	4	5,695	nw.	50	nw.	7	8	7	16	6.5	1.6
Northern Slope.							**26.4**	**+ 3.9**									**74**	**0.31**	**−0.3**									**4.8**	
Havre	2,505	46	53	27.27	30.01	−.09	21.6	+ 11.9	51	6	33	−11	29	10	40	19	16	81	0.33	−0.6	5	8,210	w.	48	sw.	6	6	17	8	5.7	3.3
Miles City	2,371	42	50	27.40	29.99	−.13	24.0	+ 13.4	50	6	33	−8	29	15	36	21	19	86	0.19	−0.4	4	4,474	s.	40	w.	6	15	13	3	3.8	1.8
Helena	4,110	88	94	25.74	30.05	−.10	29.1	+ 12.0	55	6	37	1	27	22	28	25	19	67	0.69	−0.7	6	5,284	sw.	45	sw.	3	10	10	11	5.6	6.9
Kalispell	2,965	45	51	26.91	30.06	−.06	27.6	.....	53	6	34	4	28	22	31	26	22	81	0.91	.....	12	3,117	w.	30	sw.	25	4	9	18	7.5	3.7
Rapid City	3,234	46	50	26.51	29.98	−.12	28.9	+ 8.7	58	6	41	−5	12	17	52	24	20	73	0.23	−0.1	5	6,141	nw.	44	w.	6	16	10	5	3.8	0.7
Cheyenne	6,088	56	64	23.90	30.04	−.01	29.4	+ 4.4	53	25	40	0	11	19	38	23	15	59	0.20	−0.2	6	10,686	nw.	55	nw.	6	12	12	7	4.4	1.8
Lander	5,372	26	36	24.58	30.11	−.01	23.0	+ 3.1	59	5	38	−15	11	8	39	18	14	74	0.25	−0.1	4	2,630	sw.	30	nw.	6	9	15	7	4.5	2.5
North Platte	2,821	43	52	27.03	30.05	−.07	29.0	+ 9.0	53	31	40	−5	12	18	44	24	20	75	0.27	−0.2	3	5,951	w.	43	nw.	7	18	12	1	3.1	3.2
Middle Slope.							**34.4**	**+ 5.3**									**68**	**0.18**	**−0.6**									**4.6**	
Denver	5,291	79	151	24.64	30.00	−.05	34.8	+ 6.6	66	6	46	9	12	23	41	27	17	54	0.12	−0.4	3	6,735	s.	45	nw.	6	15	8	8	4.4	1.9
Pueblo	4,685	80	86	25.23	30.02	−.03	33.8	+ 5.1	68	6	48	2	12	20	42	26	17	55	0.23	−0.2	4	5,060	nw.	40	nw.	24	10	17	4	4.3	2.1
Concordia	1,398	42	47	28.53	30.06	−.08	30.7	+ 7.5	55	*	39	1	12	23	32	26	22	76	0.27	−0.4	5	5,414	s.	38	nw.	7	16	10	5	3.7	2.3
Dodge	2,509	44	54	27.39	30.06	−.05	33.4	+ 6.8	70	6	47	5	11	20	43	27	22	75	0.08	−0.4	4	7,703	s.	36	nw.	7	9	11	11	5.6	0.4
Wichita	1,358	78	86	28.59	30.07	−.06	34.8	+ 4.2	65	28	45	5	12	25	36	30	25	73	0.08	−0.8	5	6,987	s.	41	nw.	7	14	9	8	4.6	0.3
Oklahoma	1,214	79	86	28.74	30.05	−.06	38.6	+ 1.6	70	28	48	13	11	29	38	34	29	74	0.27	−1.2	7	8,391	n.	40	n.	7	10	9	12	5.1	....
Southern Slope.							**42.0**	**+ 4.6**									**66**	**0.82**	**0.0**									**4.4**	
Abilene	1,738	45	54	28.23	30.08	−.01	45.4	+ 2.6	79	28	55	21	12	36	37	38	33	71	1.51	+ 0.6	7	6,581	s.	38	nw.	23	14	6	11	4.9	0.7
Amarillo	3,676	43	52	26.22	30.03	−.03	38.6	+ 6.7	74	28	50	17	21	27	37	30	22	62	0.12	−0.6	2	10,054	sw.	42	nw.	4	18	12	1	3.8	1.2
Southern Plateau.							**43.2**	**+ 2.6**									**47**	**0.31**	**−0.9**									**3.4**	
El Paso	3,762	10	110	26.20	30.03	+.02	45.8	+ 1.3	75	28	58	23	12	34	37	36	25	53	0.61	+ 0.1	4	8,660	nw.	44	w.	31	15	13	3	3.7	1.0
Santa Fe	7,013	47	50	23.20	30.09	+.05	30.4	+ 2.5	49	6	40	13	3	21	27	24	15	55	0.11	−0.5	5	5,441	nw.	28	nw.	22	20	9	2	2.8	1.1
Flagstaff	6,907	12	25	23.33	30.03	−.02	30.4	+ 1.6	54	24	42	6	19	18	38	25	.....	.....	0.45	−3.2	5	.....	w.	....	.....	...	18	7	6	3.7	3.6
Phoenix	1,108	50	56	28.88	30.05	+.02	51.8	+ 2.0	76	6	65	31	2	38	38	43	33	53	T.	−0.8	0	2,677	e.	18	e.	14	17	9	5	3.9	
Yuma	141	16	50	29.89	30.04	−.01	56.0	+ 1.8	76	5	69	33	31	42	37	44	39	41	T.	−0.4	0	4,371	n.	27	n.	13	23	4	4	1.8	
Independence	3,910	51	58	26.05	30.07	.00	44.5	+ 6.1	66	4	56	22	30	34	32	33	15	33	0.71	−0.5	3	5,388	nw.	75	w.	25	14	8	9	4.6	T.
Middle Plateau.							**30.2**	**+ 1.7**									**71**	**1.55**	**+ 0.1**									**4.6**	
Carson City	4,720	82	92	25.33	30.15	+.02	34.5	+ 2.2	60	3	48	−3	29	22	40	30	24	68	2.17	−0.4	6	4,928	s.	63	sw.	26	15	5	11	4.2	12.2
Winnemucca	4,344	59	70	25.67	30.17	+.01	30.6	+ 3.6	59	24	43	−4	29	18	40	28	24	76	1.78	+ 0.7	10	6,789	ne.	61	sw.	26	16	3	12	4.9	12.5
Modena	5,479	10	38	24.64	30.11	+.01	32.1	.....	58	6	44	7	30	20	38	26	19	64	0.12	.....	2	6,710	w.	43	s.	28	18	5	8	3.7	1.9
Salt Lake City	4,366	105	110	25.68	30.15	.00	32.0	+ 4.1	53	27	39	15	29	25	26	29	24	73	2.11	+ 0.7	11	3,548	se.	44	n.	26	10	9	12	5.6	7.5
Grand Junction	4,608	43	51	25.46	30.26	+.20	23.8	− 3.2	56	28	36	− 1	1	12	31	20	15	73	0.15	−0.5	5	2,823	e.	24	sw.	28	12	13	6	4.5	1.6
Northern Plateau.							**32.8**	**+ 0.2**									**84**	**1.68**	**−0.4**									**7.8**	
Baker City	3,471	53	58	26.49	30.17	+.01	26.5	+ 3.7	50	24	32	6	29	21	21	25	23	86	1.15	−0.5	15	3,842	se.	36	sw.	24	5	2	24	7.8	6.7
Boise	2,739	61	68	27.28	30.23	+.04	32.2	+ 4.8	57	24	37	17	15	27	24	30	27	86	2.52	+ 0.2	13	3,002	nw.	26	e.	29	2	6	23	8.6	5.8
Lewiston	757	52	61	29.28	30.11	−.05	39.3	+ 4.1	58	3	44	24	29	34	18	.....	.....	.....	1.07	−0.2	14	2,668	e.	30	nw.	24	2	8	21	8.1	1.2
Pocatello	4,482	46	54	25.52	30.19	−.01	28.2	+ 9.1	48	6	35	5	17	21	26	25	22	80	1.77	−0.3	11	7,156	e.	36	sw.	22	8	11	12	5.8	13.2
Spokane	1,943	101	110	28.00	30.11	−.01	32.1	+ 7.6	48	24	36	15	28	28	17	30	28	85	2.23	−0.3	17	4,475	s.	30	s.	5	2	2	27	8.9	6.0
Walla Walla	1,000	65	73	29.03	30.13	−.02	38.2	+ 7.7	59	*	42	20	28	34	17	36	33	83	1.34	−1.1	11	4,291	s.	32	se.	29	1	12	18	7.7	1.3
N. Pac. Coast Reg.							**42.6**	**+ 3.2**									**87**	**8.34**	**−0.5**									**8.2**	
North Head	211	11	56	29.76	29.99	−.06	45.0	+ 4.1	59	13	49	33	31	41	15	44	42	91	8.74	+ 0.2	23	14,660	se.	84	se.	29	6	0	25	8.2	2.0
Port Crescent	259	13	20	29.69	29.94	−.05	39.8	+ 4.3	55	5	44	27	28	35	17	.....	.....	.....	7.08	0.0	20	2,566	e.	30	sw.	23	0	6	25	8.7	3.0
Seattle	123	114	151	29.89	30.03	−.02	42.9	+ 2.1	57	4	47	30	16	39	14	41	39	86	3.12	− 1.4	19	6,761	se.	34	s.	24	3	6	22	7.8	1.5
Tacoma	213	113	120	29.80	30.04	.00	41.5	+ 3.5	57	4	46	28	16	37	15	.....	.....	.....	8.23	+ 1.8	20	5,007	sw.	28	sw.	24	0	0	31	9.5	3.8
Tatoosh	86	7	57	29.83	29.93	−.05	43.4	+ 2.8	52	8	46	33	31	40	10	42	40	88	10.05	− 2.7	22	17,598	e.	72	e.	7	4	7	20	7.9	0.2
Astoria	20	57	64	.....	.....	.....	44.1	+ 3.6	55	4	49	33	16	39	15	.....	.....	.....	14.52	− 3.8	22	.....	ne.	....	.....	...	7	1	23	7.5	4.0
Portland, Oreg	154	68	96	29.90	30.07	−.01	42.8	+ 4.4	57	4	47	29	11	39	16	40	37	80	5.43	− 1.7	20	5,397	sw.	30	e.	14	4	6	21	7.8	0.8
Roseburg	518	56	67	29.52	30.09	−.01	41.5	+ 1.2	60	3	46	29	15	37	22	40	39	91	9.58	+ 3.4	17	1,989	s.	20	sw.	26	4	6	21	7.9	7.1
Mid. Pac. Coast Reg.							**46.8**	**− 0.2**									**86**	**5.65**	**+ 0.3**									**6.4**	
Eureka	62	62	80	30.06	30.12	+.02	48.6	+ 2.6	66	7	54	36	31	44	19	46	44	86	16.07	+ 8.5	17	4,167	se.	38	sw.	26	3	8	20	7.4	T.
Mount Tamalpais	2,375	11	18	27.64	30.13	+.02	45.9	.....	68	5	51	31	31	41	21	42	37	78	6.37	.....	13	14,344	nw.	86	nw.	25	12	9	10	4.9	1.1
Red Bluff	332	50	56	29.78	30.15	+.03	43.6	− 1.3	66	12	51	28	16	36	36	41	40	89	2.78	− 1.9	10	4,146	se.	36	se.	26	7	10	14	6.4	
Sacramento	69	106	117	30.09	30.17	+.05	43.4	− 2.2	60	24	47	29	17	39	18	42	40	90	3.05	− 0.8	10	5,024	se.	40	se.	26	2	4	25	8.5	
San Francisco	155	161	167	30.01	30.17	+.06	47.9	− 2.2	59	23	53	37	15	43	14	46	44	87	3.73	− 1.0	12	5,682	n.	34	s.	27	11	7	13	5.5	
Point Reyes Light	490	7	30	.....	.....	.....	50.7	+ 2.1	70	6	55	39	31	46	20	.....	.....	.....	2.64	− 3.4	9	11,762	nw.	72	s.	27	10	..	14	6.0	
S. Pac. Coast Reg.							**53.1**	**+ 2.5**									**71**	**2.08**	**− 0.6**									**4.6**	
Fresno	330	67	70	29.81	30.17	+.07	44.0	− 0.5	66	24	50	26	16	38	26	42	40	87	1.86	+ 0.5	8	2,489	e.	18	nw.	25	4	3	24	8.0	
Los Angeles	338	116	123	29.71	30.08	.00	56.6	+ 3.5	85	4	67	39	17	46	40	49	42	66	2.10	− 0.8	5	3,546	ne.	18	s.	28	13	13	5	3.8	
San Diego	87	94	102	29.97	30.07	.00	56.8	+ 3.2	78	6	65	43	17	49	25	50	44	69	0.69	− 1.3	4	3,805	ne.	24	s.	15	21	3	7	3.3	
San Luis Obispo	201	46	48	29.93	30.16	+.07	55.0	+ 3.9	81	5	66	30	30	45	40	47	40	63	3.67	− 1.0	7	4,546	n.	24	w.	25	18	6	7	3.5	
West Indies.																														
Bridgetown	30	57	65	29.94	29.97	+.02	78.0	+ 3.2	85	7	83	68	25	72	15	72	69	75	1.12	− 1.6	17	6,749	e.	26	e.	15	11	13	7	4.9	
Grand Turk	11	6	20	30.02	30.03	.00	77.1	.....	86	19	83	68	8	72	16	.....	.....	.....	2.48	.....	12	.....	e.	....	.....	...	20	7	4	3.8	
Havana	57	87	105	29.97	30.03	−.02	72.4	+ 2.1	83	25	78	55	10	67	20	.....	.....	.....	2.88	+ 0.2	14	8,427	e.	34	nw.	6	9	18	4	5.0	
Kingston	286	38	52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Puerto Principe †	352	55	62	29.67	30.02	.00	73.2	.....	87	19	82	52	7	64	24	68	67	91	1.64	.....	10	3,994	ne.	24	e.	10	15	7	4	4.0	
San Juan	82	48	90	29.94	30.04	+.02	76.8	.....	86	6	82	68	3	71	16	71	69	81	2.09	− 0.9	14	8,129	e.	29	e.	11	11	19	1	4.4	

NOTE.—The data at stations having no departures are not used in computing the district averages. * More than one date. † Record for first 26 days of month only.

TABLE II.—*Climatological record of voluntary and other cooperating observers, January, 1903.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	75	17	41.8	2.68	
Benton				2.49	
Birmingham	75	20	45.6	2.90	
Bridgeport				2.94	T.
Burkeville				1.95	
Calera				3.61	
Camphill	76	18	44.8	3.00	
Citronelle	76	22	49.6	3.92	
Cordova	81	14	42.6	4.33	
Daphne	74	23	50.5	5.61	
Decatur	77	19	45.4	3.52	
Demopolis				3.96	
Dothan	74	23	49.2	4.25	
Eufaula	75	29	46.0	4.11	
Eutaw	72	20	45.5	3.98	
Evergreen	74	20	46.9	3.20	
Flomaton	76	18	48.6	4.25	
Florence *a*				5.04	
Florence *b*	76	15	41.6	5.11	T.
Fort Deposit	74	21	44.1	3.00	
Gadsden	76	18	42.0	3.86	
Goodwater	74	17	41.4	3.33	
Greensboro	75	23	46.4	3.50	
Greenville				3.20	
Hamilton	76	10	41.7	4.45	
Helena				4.29	
Highland Home	76	20	47.3	2.17	
Letohatchie				2.90	
Livingston *a*		20		3.96	
Lock No. 4	63	17	39.2	3.57	
Madison Station	77	15	42.8	3.09	
Maplegrove	74	16	39.4	3.11	T.
Marion	74	20	43.0	3.74	
Milstead				2.51	
Newbern	77	19	46.4	3.70	
Newburg	79	13	41.4	4.40	
Notasulga				2.44	
Oneonto	73	15	41.7	2.85	T.
Opelika	71	20	42.5	3.36	
Oxanna	73	17	43.0	0.11	T.
Ozark	75	20	45.1	4.26	
Prattville	84	14	46.0	3.24	T.
Pushmataha	76	18	46.0	5.15	T.
Riverton	77	10	38.4	4.62	T.
Scottsboro	73	15	38.8	2.93	T.
Selma	75	20	44.2	2.42	
Talladega	75	17	44.1	2.56	
Tallassee				2.92	
Thomasville	75	20	44.3	3.70	T.
Tuscaloosa	77	19	42.5	3.81	
Tuscumbia	74	16	39.8	5.02	
Tuskegee	76	20	47.3	2.36	
Union Springs	74	24	45.1	3.60	
Uniontown	75	19	46.2	3.14	
Valleyhead	72	13	40.6	3.04	T.
Verbena				3.54	
Wetumpka	78	20	42.4	3.61	
Alaska.					
Copper Center	49	−55	−8.6		
Fort Egbert	41	−61	−19.3	0.58	6.5
Fort Liscum	36	−10	16.2	10.42	108.0
Killisnoo	41	4	27.1	4.05	25.5
Orca				16.74	57.0
Sitka	54	10	33.8	6.61	19.0
Skagway	47	−17	19.6	2.08	5.2
Arizona.					
Agua Caliente	78	27	51.8	T.	
Allaire Ranch				0.04	
Arizona Canal Co's Dam	74	33	54.4	0.18	
Aztec	78	35	56.6	0.10	
Bisbee	70	21	45.8	0.30	1.5
Bowie	66	26	46.5	0.05	
Buckeye	76	28	49.8	0.00	
Casagrande	77			0.00	
Champie Camp	81	23	49.4	T.	
Cochise [1]	76	28	50.7	T.	
Congress	72	37	52.0	0.23	
Dragoon Summit [1]	52	26	37.2	0.00	
Dudleyville	78	22	48.2	1.04	T.
Duncan	72	15	41.7	0.04	0.5
Fort Apache	67	11	37.8	0.20	2.0
Fort Defiance	48	−2	24.8	0.42	4.2
Fort Grant	67	26	46.0	T.	
Fort Huachuca	69	30	47.0	0.44	0.4
Globe	70	23	46.4	0.00	
Jerome	66	29	43.2	0.50	T.
Maricopa	73	28	48.0	0.00	
Mesa	79	29	51.4	T.	
Mesa (near)	78	27	49.2	0.00	
Mount Huachuca	69	27	45.6	0.38	1.0
Mohawk Summit [1]	72	40	54.7	0.00	
Natural Bridge				0.25	0.5
Nogales				T.	
Oracle	64	30	46.2	0.23	
Oro				0.09	
Phoenix	77	28	50.1	T.	
Pima	70	20	44.4	0.10	
Pinal Ranch				T.	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Prescott	65	10	35.6	0.74	4.0
San Simon	73	20	43.7	T.	
Sentinel [1]	70	39	53.6	0.00	
Showlow				T.	T.
Signal	80	23	49.3	0.14	
Superstition				0.05	
Taylor	60	8	32.9	0.13	1.1
Tonto	68	23	45.3	0.15	
Tuba	58	10	34.5	0.00	
Tucson	76	27	48.9	0.00	
Vail [3]	78	35	53.9	0.00	
Walnut Grove				0.00	
Willcox [1]	68	25	45.0	0.21	
Yarnell				0.05	
Arkansas.					
Alco	71	11	38.9	2.13	0.6
Amity	77	15	40.3	2.53	
Arkadelphia	77	16	43.3	2.60	
Arkansas City				5.50	
Batesville	76	9	39.6	2.43	
Blanchard	79	16	44.8	3.61	
Brinkley	76	19	41.3	2.42	
Camden *a*				3.53	
Camden *b*	79	24	46.3	2.37	
Conway	76	16	40.2	2.56	
Corning	73	13	37.0	2.52	0.4
Dallas	69	13	41.0	1.58	
Dardanelle				1.76	
Dodd City	68			1.90	T.
Dutton	73	8	36.6	2.85	2.0
Eureka Springs	65	7	37.4	1.37	1.8
Fayetteville	66	8	35.8	1.39	0.5
Forrest City	74	18	40.4	3.30	T.
Fulton				1.86	
Hardy	73	11	37.7	1.81	T.
Helena *a*				5.02	
Jonesboro	75	13	39.3	3.50	T.
Lake Village	79	20	44.7	5.29	T.
Lonoke	76	17	40.4	3.32	
Lutherville	70	18	37.6	2.26	T.
Malvern	79	17	41.0	3.60	T.
Marianna	73	17	40.8	4.38	T.
Marvell	76	18	43.5	4.22	
Mossville	62	10	34.1	1.92	T.
Mountain Home	75	11	38.8	1.40	T.
Mount Nebo	67	14	38.0	1.58	T.
New Gascony	75			2.25	
Newport *a*				3.23	T.
Newport *b*	76	14	40.0	3.50	
Newport *c*	76	15	40.6	3.45	T.
Oregon	69	7	36.4	2.00	1.6
Ozark	73	13	39.6	1.46	0.5
Paragould	74	15	38.3	2.21	T.
Perry	74	16	39.8	2.35	
Pinebluff		16		2.94	
Pocahontas	74	9	37.2	2.27	T.
Pond	67	4	35.8	1.15	0.5
Prescott	78	19	44.7	2.76	
Princeton	78	14	42.4	3.07	
Rison	76	12	41.2	2.98	
Rosadale	79	16	43.8	1.52	
Russellville	70	17	40.0	1.61	
Silversprings	65	8	37.6	0.42	T.
Spielerville	74	15	40.0	1.81	T.
Stuttgart	76	19	42.2	3.42	
Texarkana	80	18	44.7	1.60	
Warren	80	17	43.0	4.35	
Washington	76	17	43.5	1.83	
Wiggs	76	12	41.2	2.33	T.
Winchester	79	18	42.2	4.81	
Winslow	63	9	35.2	1.81	4.0
Witts Springs	64	9	33.4	2.21	1.0
California.					
Angiola	73	19	42.1	0.75	
Azusa	80	38	56.2	2.26	
Bagdad	74	31	53.4	0.00	
Bakersfield	72	23	45.0	1.27	
Ballast Point L. H				0.87	
Barstow	69	26	45.0	0.50	
Berkeley	59	33	46.4	5.17	
Bishop	76	13	42.4	0.46	0.5
Boca [1]	48	−14	23.7	6.40	64.0
Bodie	48	−19	23.0	2.88	24.0
Bowman	58	8	36.0	19.97	85.0
Branscomb				22.30	6.0
Caliente [1]	59	30	45.7	2.15	
Campbell	65	28	46.9	2.69	
Campo				1.85	
Cape Mendocino L. H				17.40	
Cedarville	59	6	32.1	2.65	17.5
Chico	60	25	41.8	3.90	T.
Cisco [1]	45	6	31.2	5.85	38.5
Claremont	83	30	52.2	2.38	
Cloverdale	64	27	47.2	6.49	
Colusa	61	29	42.7	2.74	
Corning [1]	70	30	47.1	1.95	
Coronado	79	41	57.2	0.58	
Crescent City	65	30	46.6	24.38	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Crescent City L. H				17.83	
Cuyamaca	58	16	37.7	3.96	
Delano [1]	67	28	46.4	1.05	
Delta [1]	72	32	46.0	11.86	4.0
Drytown	61	26	42.6	6.30	
Dunnigan [1]	62	28	44.2	3.93	
Durham [3]	62	29	43.0	3.73	
East Brother L. H				3.70	
Elcajon	84	31	53.3	0.84	
Elmdale	67	25	43.4	2.84	
Elsinore	87	28	53.6	0.81	
Escondido	78	25	49.6	1.58	
Fallbrook	82	33	53.2	3.11	
Folsom [1]	65	28	45.0	5.23	
Fordyce Dam				11.51	80.0
Fort Bragg				8.54	
Fort Ross	68	36	48.4	9.85	
Foster				2.13	
Georgetown	71	22	45.0	14.77	6.0
Geyserville	53	30	40.8	4.85	
Gilroy (near)	68	21	48.0	2.87	
Glendora				3.87	
Greenville	56	10	34.5	7.44	36.0
Hanford	69	18	40.8	1.31	
Healdsburg	61	28	45.4	7.55	
Hollister	68	23	47.6	2.78	
Humboldt L. H				16.33	
Idylwild				3.82	
Imperial	83	32	56.4	T.	
Indio [1]	90	37	58.2	0.00	
Iowa Hill [1]	69	29	46.4	12.54	4.0
Irvine	86	32	57.8	1.42	
Jackson	72	29	45.8	9.12	T.
Jamestown	67	25	44.0	11.19	T.
Jolon				2.34	
Kennedy Gold Mine	58	24	40.0	11.78	
Kent	64	28	46.0	10.51	
Kernville				2.05	
King City	79	24	49.3	1.19	
Lakeport (near)	56	30	44.8	5.37	
Lamesa				1.10	
Laporte [1]	59	11	35.1	16.42	62.3
Lemoncove	70	26	45.1	2.22	
Lick Observatory	68	24	43.7	8.86	10.0
Lime Point L. H				3.62	
Livermore	67	23	47.4	3.19	
Lodi	65	27	44.6	3.21	
Los Gatos	63	31	47.0	5.93	
Mammoth [1]	78	31	60.1	0.00	
Manzana	67	23	46.2	0.60	
Mare Island L. H				3.30	
Meadow Valley	56	12	34.9	9.48	62.0
Merced	65	25	41.4	2.24	
Mercury	66	34	51.2	9.28	
Mills College				5.68	
Milo				5.38	
Milton (near)	60	28	43.4	4.52	
Modesto [1]	65	29	47.2	2.34	
Mohave [1]	66	25	46.5	0.02	
Mokelumne Hill [3]		31	41.2	7.89	
Monterio	74	26	48.4	1.94	
Monterey [1]	65	32	49.2	3.43	
Mount St. Helena				12.07	5.0
Mutah Flat				2.50	4.0
Napa	62	29	45.0	3.22	
Nevada	75	21	43.7	10.62	8.0
Newcastle	59	25	42.4	8.88	
Newhall [3]	80	24	54.8	1.13	
Newman	66	24	42.4	1.47	
Niles	64	29	47.8	4.26	
North Bloomfield	73	18	43.2	12.72	19.0
North San Juan [1]	62	24	42.5	12.88	3.0
Oakland	62	32	47.5	4.02	
Ogilby [3]	82	48	65.6	0.00	
Ontario	81	33	53.3	1.34	
Orland [1]	63	28	45.2	2.27	
Palermo	59	25	41.7	6.62	
Paso Robles	68	19	44.8	2.19	
Peachland [3]	59	32	46.6	9.36	
Piedras Blancas L. H				3.20	
Pigeon Point L. H				3.86	
Pilot Creek				16.04	31.0
Pine Crest	79	42	58.6	3.13	
Placerville	62	23	42.1	9.33	
Point Ano Nuevo L. H				4.62	
Point Arena L. H				7.35	
Point Bonita L. H				8.08	
Point Conception L. H				1.05	
Point Fermin L. H				1.69	
Point George L. H				8.24	
Point Hueneme L. H				1.82	
Point Lobos	57	37	47.4	3.84	
Point Loma L. H				0.28	
Point Montara L. H				5.90	
Point Pinos L. H				4.69	
Point Sur L. H				3.80	
Porterville	72	24	45.2	1.80	
Poway	80	30	53.6	2.22	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Quincy	54	10	34.4	9.31	33.0
Ranch House	86	36	57.0	1.54	
Redding	70	27	44.4	10.14	T.
Redlands	85	33	53.0	1.16	
Reedley	68	25	44.8	2.16	
Represa	68	28	44.2	5.77	
Riovista	64	28	44.4	2.86	
Riverside	84	27	52.0	0.94	
Roe Island L. H				3.20	
Rohnerville [2]	60	28	46.8	14.34	
Rosewood	70	23	43.2	4.79	1.00
Sacramento	62	29	44.7	3.81	
Salinas	75	29	50.2	3.14	
Salton [1]	83	34	58.3	0.00	
San Bernardino	85	27	52.6	1.96	
San Jacinto	80	27	50.7	1.32	
San Jose	69	29	48.8	2.74	
San Leandro	65	30	46.5	4.89	
San Luis L. H				2.39	
San Mateo [1]	62	38	49.1	6.30	
San Miguel [1]	69	23	47.4	1.27	
Santa Barbara	80	37	56.4	2.06	
Santa Barbara L. H				1.80	
Santa Clara				2.99	
Santa Clara College	69	26	47.8	3.09	
Santa Cruz	77	30	49.4	6.25	
Santa Cruz L. H				4.86	
Santa Maria	80	32	54.8	1.80	
Santa Monica	80	36	54.9	1.14	
Santa Paula	85	38	61.6	1.66	
Santa Rosa	60	27	45.6	6.38	
Sausalito				17.47	
Shasta	71	30	47.6	17.24	2.0
Sierra Madre	77	39	55.2	4.84	
Snedden				0.59	
Sonoma				5.46	
S. E Farallone L. H				2.99	
Stockton	63	25	42.8	2.50	
Storey	71	25	45.6	1.55	
Summerdale	71	15	41.4	14.13	30.0
Summit [1]	48	9	30.9	10.50	85.0
Susanville	52	6	31.8	3.71	31.0
Tehama [1]	60	30	47.0	2.40	
Tejon Ranch	71	30	47.2	2.19	
Trimmer				5.83	
Trinidad L. H				17.91	
Truckee [1]	50	−8	27.7	8.00	80.0
Tulare *b*				1.26	
Tulare *c*	74	24	45.5	1.60	
Tustin	84	42	59.2	1.49	
Ukiah	63	24	45.9	7.26	0.5
Upland	80	33	52.5	3.97	
Upperlake	68	24	43.3	6.23	
Upper Mattole [1]	60	34	46.2	23.05	
Vacaville [1]	62	28	44.2	4.95	
Ventura	83	40	58.7	0.88	
Visalia	69	22	43.5	1.77	
Volcano Springs [1]	80	38	61.5	0.00	
Wasco	75	23	42.4	1.40	
Westpoint				10.39	1.5
West Saticoy				1.17	
Wheatland	60	27	42.5	6.31	
Williams [1]	66	35	49.1	2.10	
Willits	60	28	45.3	12.36	3.0
Willow	62	27	43.1	2.48	
Yuba City [5]	63	30	46.2	5.17	
Zenia	73	26	44.3	17.29	18.0
Colorado.					
Alford	54	7	31.6	0.10	2.5
Ashcroft	43	−9	17.0	0.80	17.0
Blaine	73	6	36.1	T.	T.
Boulder	67	8	37.4	0.08	2.0
Boxelder				0.11	1.0
Breckenridge	34	−24	14.7	1.50	25.5
Buenavista				0.05	1.0
Canyon	63	2	35.4	0.05	1.0
Castlerock	58	0	30.2	0.62	6.0
Cedaredge	51	1	24.5	0.30	4.5
Cheesman	60	−4	29.4	0.14	3.3
Cheyenne Wells	70	3	32.0	0.34	4.0
Clearview	50	−4	24.4	0.35	6.0
Colorado Springs	63	4	32.4	0.11	3.5
Collbran	46	−8	21.4	0.45	7.0
Delta	47	−18	15.8	0.12	1.7
Durango	42	1	24.2	0.35	4.0
Fort Collins	61	1	30.3	0.16	1.0
Fort Morgan	51	−5	25.2	T.	T.
Fox	64	9	31.8	0.15	1.5
Fruita	59	−10	22.1		
Garnett	40	−23	11.1	0.01	0.4
Gilman				2.86	47.5
Gleneyre	65	2	30.8	0.31	2.2
Glenwood	49	−12	22.8	1.03	16.0
Greeley	61	0	29.2	0.02	0.2
Grover				T.	T.
Gunnison	38	−35	6.0	0.69	10.6
Hamps	57	−2	27.4	0.20	2.8
Hoehne				0.14	1.5
Holyoke (near)	63	0	30.1	0.05	1.5
Husted	64	−2	29.2	0.03	1.2
Lake Moraine	42	−5	21.6	0.45	5.2
Lamar	72	8	36.2	0.04	0.5
Laporte				0.15	1.0
Las Animas	70	4	32.4	0.09	
Lay	46	−23	17.0	1.03	18.5
Leadville (near)				1.87	28.5
Leroy	58	2	29.8	0.18	3.0
Longs Peak	48	−7	24.8	0.22	5.0
Mancos	50	−1	25.2	0.42	4.8
Marshall Pass				1.02	20.0
Meeker	45	−15	19.8	0.77	11.5
Moraine	52	3	26.8	0.12	2.0
Pagoda	50	−12	21.8	0.99	18.0
Parachute	48	−6	23.7	0.50	8.5
Rangely		−26		0.45	7.5
Rockyford	70	5	34.6	T.	T.
Rogers Mesa	44	−4	20.7	0.70	5.5
Ruby				4.73	73.0
Russell	46	−22	15.0	0.43	4.5
Saguache	42	−11	17.3	0.15	2.5
Salida	56	−2	28.2	T.	T.
San Luis	49	−17	17.7	0.03	0.5
Santa Clara	55	−1	29.4	0.40	9.0
Silt	45	2	25.1	0.71	10.5
Sugarloaf	59	0	29.8	0.15	2.0
Telluride	47	−5	19.4	2.19	34.8
Trinidad	64	8	35.0	T.	0.0
Twinlakes				0.36	5.5
Vilas				T.	T.
Wagon Wheel	51	−26	13.0	0.22	3.5
Wallet				T.	T.
Waterdale	65	−1	32.4	0.18	2.0
Westcliffe	50	−1	25.4	0.34	4.3
Whitepine	35	−13	12.2	1.24	22.6
Wray	67	4	32.1	0.25	3.0
Yuma				0.14	3.0
Connecticut.					
Bridgeport	48	4	28.9	4.28	7.5
Canton	50	−9	23.5	4.10	11.0
Colchester	51	0	28.8	3.83	6.0
Gaylordsville				4.42	
Hartford	45	0	26.5	3.70	5.0
Hawleyville	47	0	26.6	4.39	12.0
Lake Konomoc				4.18	
New London	48	4	28.0	2.94	17.5
North Grosvenor Dale	52	−2	25.0	3.93	
Norwalk	48	2	27.8	4.45	7.0
Southington	47	−2	26.8	3.80	6.0
South Manchester				2.86	7.0
Storrs	47	−10[3]	26.2	3.79	4.5
Voluntown	52	−3	28.6	4.84	4.5
Waterbury	49	−2	26.9	3.78	10.5
West Simsbury				4.02	6.0
Delaware.					
Delaware City				3.17	3.5
Milford	59	12	35.4	3.35	3.0
Millsboro	60	12	34.4	4.39	5.3
Newark	50	8	30.2	4.29	5.0
Seaford	56	12	34.3	3.46	4.0
District of Columbia.					
Distributing Reservoir [6]	54	11	33.1	4.10	
Receiving Reservoir [6]	50	10	32.4	3.77	
West Washington	62	8	32.2	4.40	2.5
Florida.					
Archer	78	24	54.6	6.21	
Avon Park	85	32	62.5	5.22	
Bartow	87	32	64.2	6.64	
Bonifay	74	20	51.2	3.15	
Brooksville	82	30	58.8	4.92	
Carrabelle	73	25	54.4	5.61	
Clermont	82	33	60.0	5.79	
De Funiak Springs	73	19	50.0	4.73	
Deland	80	25	59.2		
Eustis	82	31	59.4	6.09	
Federal Point	81	32	55.6	5.56	
Fernandina	79	29	52.0	6.84	
Flamingo	88	39	69.9	3.45	
Fort George [1]	71	26	52.8		
Fort Meade	85	28	61.8	9.14	
Fort Myers	79	40	62.6	4.76	
Fort Pierce	81	33	62.4	4.78	
Gainesville	80	25	54.0	5.15	
Grasmere	79	30	58.4		
Holt [6]	72	18	48.4	4.11	
Huntington	85	29	56.8	6.39	
Hypoluxo	83	37	67.4	5.70	
Inverness	77	27	55.6	5.73	
Jasper	78	27	52.3	4.11	
Johnstown	79	27	52.6	7.21	
Kissimmee	81	28	60.2	4.76	
Lake City	81	25	53.6	4.50	
Macclenny	82	25	53.9	6.31	
Malabar	82	31	61.7	4.34	
Manatee	83	32	62.0	6.84	
Marco	84	40	66.2	5.11	
Marianna	72	23	47.4	3.93	
Merritt Island	80	37	60.8	4.56	
Miami	83	36	69.0	4.99	
Molino	77	20	50.0	5.45	
New Smyrna	81	27	58.6	4.10	
Nocatee	87	31	63.6	4.65	
Ocala	82	25	56.6	6.52	
Orange City	83	25	61.0	5.01	
Orlando	80	34	60.2	5.69	
Pinemount	80	23	51.0	4.59	
Rockwell	79	22	56.4	3.95	
St. Andrews	71	21	50.4	5.56	
St. Augustine	83	29	55.4	4.47	
St. Leo	83	31	60.0	7.37	
Stephensville	80	22	51.8	3.36	
Sumner	76	28	54.8	4.57	
Switzerland	76	28	54.0	4.87	
Tallahassee	73	26	51.4	3.28	
Tarpon Springs	81	30	59.8	5.23	
Waukeenah	74	24	50.9	3.61	
Wausau	74	18	50.8	4.66	
Wewahitchka	75	24	52.0	4.99	
Georgia.					
Adairsville	71	18	41.2	2.79	
Albany	72	26	48.2	4.09	
Alpharetta	72	16	41.4	2.75	T.
Americus	70	20	44.5	4.00	
Athens	66	19	40.9	3.11	
Blakely	75	21[c]	46.7	3.86	
Bowersville	67	17	40.2	4.26	
Brent	70	17	43.2	2.75	
Butler				3.17	
Camak	69	19	41.6	2.77	
Canton				2.61	T.
Carlton				3.05	
Clayton	67	12	39.4	4.73	
Columbus	75[f]	23[f]	47.9[f]	3.55	
Coney	75	18	47.9	3.08	
Covington	69	18	41.2	2.38	T.
Dahlonega	67	14	38.9	4.60	T.
Diamond	70	11	38.1	3.00	5.0
Douglas	78	25	50.6	3.85	
Dublin				3.11	
Dudley	73	23	46.8	3.76	
Eastman				3.24	
Eatonton	70	19	44.4	2.48	
Elberton	66	18	41.8	3.37	
Experiment	69	18	42.5	1.67	T.
Fitzgerald	74	19	48.2	3.23	
Fleming	87	21	50.1	3.68	
Fort Gaines	73	23	46.4	4.02	
Gainesville	66	16	38.5	4.09	
Gillsville	69	17	42.1	2.26	
Greensboro	69	18	41.2	2.50	
Griffin	69	19	41.8	2.12	T.
Harrison	72	22	46.9	4.20	
Hawkinsville	73	21	45.4	2.78	
Hephzibah	71	20	45.6	3.15	
Jesup	80	24	49.8	3.69	
Lost Mountain	73[c]	15[c]	42.2[c]	2.56	
Louisville	72	22	46.5	2.52	
Lumpkin	74	18	46.4	3.33	
Marshallville	70	21	46.6	3.92	
Mauzy	77	21	50.6	3.16	
Milledgeville	70	22	43.0	3.50	
Millen	76	19[f]	47.6[4]	1.34	
Monticello	70	19	42.8	2.22	
Morgan	74			3.62	
Naylor	78	23	49.6	4.61	
Newnan	69	18	40.6	2.15	
Oakdale				2.79	T.
Point Peter	66	22	41.8	3.44	
Poulan	77	17	47.3	3.20	
Putnam	73	19	46.4	3.21	
Quitman	77	24	49.8	3.40	
Ramsey	70	13	41.6	3.10	T.
Resaca				3.60	T.
Rome	74	16	41.6	2.71	T.
St. Marys	78	25	51.5	6.70	
Statesboro	78	23	47.9	3.17	
Stillmore	77	21	47.4	3.46	T.
Talbotton	72	19	45.4	3.75	
Tallapoosa	73	14	39.4	3.29	
Thomasville	72	24	50.6	3.71	
Toccoa	67	17	39.8	4.31	
Valona	80	23	50.6	1.75	
Vidalia	77	22	48.2	3.28	
Washington				4.64	T.
Waverly	82	25	51.0	4.69	
Waycross	80			3.58	
Waynesboro	72	22	44.6	1.32	
Westpoint	75	17	42.8	2.34	
Woodbury	72	19	41.8	1.54	
Idaho.					
Albion	52	8	30.2	1.40	8.0
American Falls	47	3	27.2	2.58	
Blackfoot	42	1	25.1	1.53	10.5
Blue Lakes	55	11	31.8	3.87	13.5
Burnside	38	−6	17.6	0.60	7.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cambridge	45	−13	22.1	3.61	21.0
Chesterfield	46	−17	18.2	2.22	22.0
Dickey	42	−19	18.2	.....	.....
Forney	50	− 9	23.0	2.62	20.5
Garnet	60	12	32.7	1.10	4.0
Grangeville	54	10	31.0	2.14	15.0
Lake	34	−16	15.0	2.20	22.0
Lakeview	48	12	32.2	5.35	20.8
Lost River	45	−13	15.9	1.12	10.0
Moscow	49	10	30.8	3.80	10.8
Murray	48	9	28.8	6.72	42.0
Oakley	49	5	29.6	1.50	8.0
Paris	44	−13	15.2	2.53	25.3
Payette	50	0	28.8	2.19	8.5
Pollock	55	18	36.6	0.53	0.7
Porthill	43	10	28.1	2.69	33.0
Priest River	44	10	28.5	5.11	.....
Riddle	50	− 3	24.2	2.19	12.0
Roosevelt	41	− 1	21.9	3.73	35.3
St. Maries	49	14	32.2	5.08	18.0
Silver City	49	9	27.8	7.86	59.5
Soldier	44	−18	14.6	3.33	31.3
Vernon	48	−11	20.2	1.87	19.2
Weston	46	2	26.0	2.36	14 4
Illinois.					
Albion	65	− 4	30.6	2.40	6.0
Aledo	49	− 5	24.5	0.73	6.0
Alexander	56	− 7	26.7	1.07	9.0
Antioch	46	−10	20.4	0.35	3.5
Ashton	47	− 8	21.6	0.94	7.8
Astoria	50	− 5	25.7	1.36	14.0
Aurora	49	− 8	23.0	0.83	5.4
Benton	67	2	33.6	1.74	1.5
Bloomington	52	− 8	25.6	1.31	9.4
Cambridge	46	− 5	25.6	0.96	9.1
Carlinville	60	− 5	29.1	1.57	11.0
Carrollton	59	− 3	28.9	1.22	7.2
Centralia	70	0	32.4	1.43	3.2
Charleston	56	− 6	28.2	1.68	9.1
Chester	.....	.....	.....	1.50	0.3
Cisne	66	− 2	31.2	1.68	1.5
Coatsburg	56	− 9	26.0	1.28	13.2
Cobden	67	3	34.8	2.26	T.
Decatur	55	−10	26.1	1.60	10.4
Dixon	48	− 7	21.2	2.76	12.5
Dwight	50	− 2	25.0	1.55	9.5
Effingham	63	− 7	28.5	2.10	7.0
Equality	68	2	33.7	2.67	5.7
Fandon	49	− 6	26.0	0.88	7.8
Flora	64	− 2	29.6	2.04	4.2
Friendgrove	63	− 4	30.8	2.58	5.1
Galva	47	− 7	23.6	0.74	11.0
Grafton	.....	.....	.....	1.67	9.5
Greenville	61	− 3	29.4	1.29	5.0
Griggsville	58	− 5	27.4	1.30	.....
Halfway	66	0	33.8	2.03	1.5
Halliday	61	3	33.3	1.22	.....
Henry	52	− 7	24.9	1.20	7.0
Hillsboro	60	− 5	28.6	1.19	7.5
Hoopeston	58	−11	26.0	1.94	14.0
Joliet	48	− 6	22.8	1.05	5.8
Kishwaukee	47	−10	20.8	0.58	6.5
Knoxville	47	− 9	23.8	1.10	6.0
Lagrange	49	− 7	23.3	0.86	4.0
Laharpe	48	− 8	25.1	2.07	10.0
Lanark	44	− 9	21.3	1.06	10.8
Loami	.....	.....	.....	1.24	9.3
McLeansboro	65	1	32.4	2.21	3.8
Martinton	53	− 8	24.2	1.29	9.0
Mascoutah	60	3	30.4	1.76	3.6
Mattoon	62	2	31.0	0.99	6.6
Minonk	50	− 7	23.8	0.71	6.0
Monmouth	48	− 8	23.4	0.63	4.3
Morrison	49	− 6	22.6	1.04	8.9
Morrisonville	59	− 6	27.7	1.47	9.0
Mount Carmel	.....	.....	.....	3.58	15.0
Mount Pulaski	53	− 7	25.4	1.18	8.5
Mount Vernon	64	2	31.5	1.66	3.7
New Burnside	67	2	34.8	1.01	1.0
Olney	66	3	30.6	2.94	9.2
Ottawa	50	− 5	26.5	1.13	6.4
Palestine	64	− 5	27.2	2.60	9.5
Pana	58	− 6	28.1	1.43	9.0
Paris	60	− 6	26.9	1.10	.....
Peoria *a*	.....	.....	.....	1.70	11.3
Peoria *b*	53	− 5	27.8	0.89	7.0
Philo	55	−12	24.7	1.45	9.4
Plumhill	63	0	31.8	1.28	2.5
Pontiac	52	− 6	26.1	0.80	5.2
Rantoul	54	−11	24.8	1.14	9.5
Raum	66	2	33.8	2.63	2.8
Riley	45	− 9	21.2	0.80	5.7
Robinson	64	− 7	27.8	2.80	11.0
Rushville	51	− 5	26.3	1.08	10.0
St. Charles	48	− 7	22.6	0.54	5.5
St. John	55	2	33.0	1.49	2.0
Shobonier	62	− 5	30.2	1.05	10.5
Streator	48	− 6	24.1	0.90	5.9
Sullivan	57	− 9	27.0	1.16	7.8
Sycamore	47	− 8	22.6	1.83	8.5
Tilden	64	2	33.0	0.95	1.6
Tiskilwa	48	− 7	23.0	0.99	6.5
Tuscola	57	− 8	25.6	1.71	11.2
Urbana	53	−12	23.8	1.04	7.5
Walnut	47	− 5	24.2	1.57	6.8
Winchester	55	− 6	27.0	1.70	13.7
Winnebago	46	− 9	21.2	0.58	7.0
Yorkville	49	− 6	23.2	0.80	3.0
Zion	54	− 6	22.8	0.50	5.0
Indiana.					
Anderson	61	− 7	26.4	2.05	12.6
Angola	53	− 9	23.5	1.59	8.8
Auburn	56	− 9	23.6	1.15	.....
Avoca	64	−14	27.6	2.85	8.5
Bloomington	62	− 4	28.8	4.44	16.0
Bluffton	59	− 9	24.6	1.30	5.2
Butlerville	63	− 4	29.6	3.18	12.8
Cambridge City	62	− 8	23.4	2.35	11.3
Columbus	64	− 8	28.7	2.44	12.0
Connersville	61	− 8	26.2	2.30	11.0
Crawfordsville	59	− 8	28.0	.....	.....
Delphi	58	− 9	22.8	2.03	11.5
Edwardsville *1	67	1	32.9	2.80	4.5
Elkhart	53	− 7	23.5	1.60	12.1
Fairmount	60	− 9	25.2	0.83	8.0
Farmland	60	− 5	25.8	2.25	13.2
Fort Wayne [1]	57	− 8	26.6	.....	.....
Franklin *1	62	− 4	29.5	2.42	14.5
Greencastle	61	− 5	27.6	1.65	12.1
Greensburg	61	− 4	28.2	2.45	12.0
Hammond	54	− 5	22.4	2.25	14.0
Hector	48	−10	24.0	2.25	12.0
Holland	65	0	32.0	3.89	3.0
Huntington	58	− 8	23.2	1.71	11.5
Jeffersonville	65	4	32.6	2.48	1.5
Kokomo	59	− 9	25.4	1.88	12.0
Lafayette	57	− 8	24.8	1.82	10.9
Laporte	48	− 5	24.4	1.58	11.2
Logansport	58	0	23.9	1.27	8.9
Madison *a*	65	0	31.0	2.44	5.2
Madison *b*	.....	.....	.....	2.63	6.0
Marengo	67	− 1	31.4	3.54	3.8
Marion	60	−10	25.4	2.12	14.5
Markle	59	− 9	25.2	2.30	14.0
Mauzy	61	− 9	26.1	2.77	15.8
Moores Hill	62	− 5	29.0	2.30	8.0
Mount Vernon	65	2	33.1	2.90	2.0
Northfield	59	−10	23.8	3.35	14.0
Paoli	64	− 1	31.0	2.64	7.5
Prairie Creek	64 [f]	− 9 [f]	26.2 [f]	1.32	16.0
Princeton	65	− 1	32.0	2.75	7.5
Rensselaer	55	− 7	26.6	1.09	9.5
Richmond	64	− 7	28.0	1.84	7.8
Rockville	60	− 9	26.8	1.54	6.0
Salem	67	− 2	31.4	3.04	7.0
Scottsburg	66	1	32.1	2.43	4.5
Seymour	64	− 6	28.4	3.09	10.5
South Bend	52	− 9	23.0	2.91	27.0
Syracuse	54	− 9	23.2	1.51	17.5
Terre Haute	64	− 4	28.9	2.32	11.5
Topeka	52	−21	23.6	0.99	8.0
Valparaiso	49	− 6	22.6	1.11	.....
Veedersburg	58	−10	27.6	2.74	12.1
Vevay	64	2	32.0	2.80	10.0
Vincennes	66	− 2	29.9	3.18	5.0
Washington	64	− 1	29.2	3.50	6.0
Winamac	56	0	28.4	.....	.....
Worthington	63	− 6	29.0	2.46	9.7
Indian Territory.					
Ardmore	78	17	40.4	1.44	
Chickasha	74	13	39.5	0.35	
Durant	80	19	42.7	1.30	
Fairland	64	6	37.2	1.05	0.5
Goodwater	79	15	43.9	1.23	
Hartshorne	75	14	42.0	0.90	
Healdton	77	9	41.3	0.72	
Holdenville	74	22	43.8	1.39	T.
Marlow	72	16	39.2	0.84	
Muskogee	67	13	39.0	1.23	
Pauls Valley	73 [e]	15 [e]	38.1 [e]	0.80	
Ravia	79	17	43.3	1.82	
South McAlester	.....	.....	.....	1.68	
Tahlequah	74	10	40.0	1.20	0.8
Tulsa	.....	.....	.....	0.30	
Webbers Falls	.....	.....	.....	2.10	
Iowa.					
Afton	47	− 4	26.0	T.	T.
Albia	51	− 5	25.8	0.40	.....
Algona	42	− 8	20.8	0.30	3.0
Allerton	52	− 8	26.0	0.48	2.0
Alta	45	− 9	21.6	0.16	1.5
Amana	46	− 3	23.5	0.28	1.8
Ames	48	− 4	24.0	0.14	1.0
Atlantic	49	− 3	25.3	T.	T.
Baxter	47	− 6	23.2	0.10	1.0
Bedford	50	− 5	26.5	0.05	0.5
Belknap	60	− 6	26.7	1.00	5.0
Belleplaine	45	− 6	21.9	0.70	5.6
Bonaparte	50	− 7	24.9	0.43	4.5
Britt	42	−10	18.7	0.39	1.5
Buckingham	.....	.....	.....	0.08	0.3
Burlington	56	− 5	26.5	0.58	.....
Carroll	48	− 9	23.4	T.	T.
Cedar Rapids	45	− 2	23.9	0.11	1.1
Chariton	51	− 5	25.4	0.25	0.6
Charles City	49	− 5	20.8	T.	T.
Clarinda	51	− 4	27.2	0.14	1.1
Clearlake	40	−12	17.8	0.25	2.5
Clinton	46	− 6	22.6	0.83	5.0
College Springs	50	− 6	27.2	0.20	2.0
Columbus Junction	49	− 4	24.5	0.28	2.7
Corning	48	− 5	25.7	0.07	0.8
Council Bluffs	57	− 4	26.8	0.03	0.1
Cumberland	.....	.....	.....	T.	T.
Danville	.....	.....	.....	1.20	.....
Decorah	41	− 8	17.8	0.31	3.0
Delaware	41	− 8	19.4	0.07	1.0
Denison	50	− 6	23.8	0.10	1.0
Dows	44	− 9	20.3	0.20	1.0
Earlham	49	− 5	24.6	0.03	0.2
Elkader	47	− 6	20.4	0.16	2.5
Estherville	42	−10	18.2	0.09	1.0
Fayette	45	− 9	19.3	0.04	0.5
Forest City	40	−10	17.9	0.10	1.0
Fort Madison	.....	.....	.....	1.46	9.5
Galva	45	− 9	21.0	0.30	3.0
Gilman	.....	.....	.....	0.10	1.0
Grand Meadow	41	−10	18.4	0.40	3.3
Greene	44	− 7	20.0	0.12	1.0
Greenfield	46	− 6	24.8	0.09	0.6
Grinnell	45	− 4	22.9	0.34	2.8
Grinnell (near)	45	− 5	22.6	0.22	2.5
Grundy Center	45	−10	21.4	0.12	1.2
Guthrie Center	47	− 6	24.9	T.	T.
Hampton	48	− 9	20.6	0.18	1.4
Hanlontown	41	−10	17.8	.....	
Harlan	47	− 6	23.6	0.05	0.2
Hopeville	.....	.....	.....	0.12	.....
Humboldt	44	− 7	21.6	0.07	0.7
Idagrove	47	− 8	23.4	0.10	.....
Independence	43	− 5	20.2	0.27	2.8
Indianola	48 [e]	− 4 [e]	25.8 [e]	0.09	0.5
Iowa City	47	− 3	23.8	0.67	3.0
Iowa Falls	45	− 8	19.7	0.20	0.7
Jefferson	.....	.....	.....	0.27	2.0
Keosauqua	50	− 5	25.4	0.84	.....
Lacona	.....	.....	.....	0.85	6.4
Larrabee	47	−10	21.4	0.11	1.0
Leclaire	.....	.....	.....	0.73	3.1
Lemars	45	− 8	22.1	0.01	T.
Lenox	47	− 7	25.3	0.03	0.3
Leon	48	− 5	26.6	0.31	2.4
Logan	48	− 4	24.2	0.70	5.0
Maple Valley	.....	.....	.....	0.20	1 5
Maquoketa	45	− 5	21.6	0.30	.....
Marshalltown	47	− 5	23.6	0.29	.....
Monticello	45	− 6	18.8	0.20	T.
Mountayr	50	−10	25.6	0.24	1.5
Mount Pleasant	52	− 5	24.2	0.15	1.0
Mount Vernon	45	− 5	21.9	0.29	2.7
New Hampton	40	−10	17.5	0.06	T.
Newton	45	− 8	22.6	0.65	8.0
Northwood	41	−10	18.8	0.40	4.0
Odebolt	45	− 7	22.9	0.28	2.8
Ogden	50	−12	23.7	0.18	1.6
Olin	48	− 3	22.2	0.31	3.5
Onawa	49	− 4	24.8	0.06	0.5
Osage	40	−10	18.0	0.31	3.1
Osceola	50	− 5	25.0	0.57	.....
Oskaloosa	49	− 5	24.3	0.22	2.7
Ottumwa	50	− 1	27.0	0.47	4.8
Ovid	53	− 9	26.2	0.32	T.
Pacific Junction	48	− 4	25.6	0.05	0.5
Pella	49	− 5	24.4	.....	.....
Perry	48	− 6 [d]	24.2 [d]	0.65	1.5
Plover	43	−10	18.9	0.11	0.5
Redoak	45	1	27.8	0.05	0.5
Ridgeway	46	− 9	20.6	1.14	5.6
Rockford	.....	.....	.....	T.	T.
Rockwell City	45	− 6	23.6	0.40	4.0
Sac City	44	− 8	22.1	0.20	2.0
St. Charles	52	− 4	26.0	0.17	1.5
Scranton	44	− 6	24.3	0.12	1.2
Sheldon	47	−10	19.9	0.05	0.5
Sibley	43	−10	18.8	0.27	2.7
Sigourney	48	− 5	24.4	0.56	1.5
Sioux Center	45	−10	20.5	0.05	0.5
Spirit Lake	42	−11	19.2	0.40	4.0
Stockport	.....	.....	.....	0.39	3.8
Storm Lake	47	−10	21.2	0.06	T.
Thurman	47	− 4	26.4	T.	T.
Tipton	45	− 3	24.2	0.35	2.5
Toledo	46	− 5	22.6	0.46	2.8
Villisca	50	− 5	26.4	0.05	0.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd	°	°	°	*Ins.*	*Ins.*
Vinton *1	42	— 1	22.8	0.12	1.2
Wapello	45d	— 1e	25.6e	0.65	4.5
Washington	49	— 7	22.3	0.38	3.5
Washta				0.05	0.5
Waterloo	44	— 5	21.5	0.17	1.3
Waukee				0.35	3.5
Waverly	45	— 6	20.6	0.19	1.5
Westbend	43	— 8	20.4	0.38	3.3
Westbranch				0.18	1.8
Whitten	45	— 8	21.4	0.15	1.5
Wilton Junction	48	— 4	23.9	1.02	5.5
Winterset	50	— 6	26.0	T.	T.
Woodburn				0.05	0.5
Kansas.					
Abilene				0.30	3.0
Achilles	64	— 7	31.4	0.09	0.9
Alton	59	— 2	31.2	0.15	1.5
Anthony				0.04	
Atchison	57	— 3	31.0	0.45	4.3
Baker	54	— 5	26.1	T.	T.
Beloit	57	— 2	30.0	T.	
Burlington	61	— 6	33.0	0.22	1.8
Chanute	59	— 1	33.6	0.69	4.8
Colby	61	— 2	30.8	0.22	1.0
Columbus	60	2	33.9	1.15	1.5
Cottonwood	61	— 4	32.2	0.32	2.7
Delphos	55	— 4	29.8	0.26	2.0
Dresden	62	0	32.7	0.05	0.5
Ellinwood	68	1	33.3	0.21	2.0
Englewood	76	7	34.0	0.43	5.0
Eureka				0.12	0.5
Eureka Ranch	68	40	32.0	0.09	0.5
Fall River	60	— 3	33.9	0.19	T.
Farnsworth	69	2	33.9	0.06	0.4
Forsha	67	— 1	33.0	0.25	1.5
Fredonia				T.	T.
Fort Leavenworth	54	— 2	29.4	0.70	7.0
Fort Scott	61	— 4	34.0	1.02	5.0
Frankfort	53	— 4	29.0	0.55	4.5
Garden City	72	8	34.9	0.25	2.0
Gove *1	65	5	32.4	0.10	1.0
Grenola	62	0	33.6	T.	T.
Hanover	50	— 2	28.3	0.54	4.0
Harrison	55	— 2	28.4	0.25	2.5
Hays	67	— 2	31.3	0.15	1.5
Holton	58	— 3	31.0	0.38	3.8
Horton	54	— 3	29.2	0.48	5.0
Hoxie	62	— 2	32.4	0.10	1.0
Hutchinson	63	— 1	32.4	0.40	4.0
Independence	60	4	45.0	0.47	2.0
Jetmore	69	4	33.8	0.05	0.5
La Crosse	70	— 2	33.0	0.15	1.5
Lakin	67	6	32.8	0.20	2.0
Lawrence	56	— 2	31.4	0.44	4.0
Lebanon	53	— 3	29.0	0.30	3.0
Lebo	60	— 1	31.8	0.36	3.0
Leoti	71	4	33.8	0.04	0.4
Little River	63	— 1	31.6	0.20	2.0
Macksville	69	0	31.2	0.22	2.2
McPherson	53	2	30.4	0.47	5.0
Madison	65	— 3	32.0	0.14	1.5
Manhattan *b*	56	— 4	31.8	0.65	4.5
Manhattan *c*	56	— 5	31.6	0.63	5.5
Marion	56	0	32.7	0.60	4.0
Meade	73	9	33.6		
Medicine Lodge	72	7	35.6	0.11	T.
Minneapolis	57	0	32.3	0.35	3.0
Moran	58	— 8	32.9	0.56	4.2
Mounthope *1	60	7	34.9	0.20	2.0
Ness City	67	4	35.4	0.42	4.0
Newton	64	1	32.2	0.40	4.0
Norwich	64	4	34.6	0.10	1.0
Oberlin				0.20	
Olathe	54	— 7	31.8	0.73	7.0
Oswego	61	0	35.4	0.96	3.2
Ottawa	63	— 7	31.6	0.62	5.0
Paola	56	— 4	32.1	0.85	5.5
Phillipsburg				0.71	6.1
Pittsburg	62	— 1	34.2	0.75	2.5
Pratt	72	2	33.1	0.10	1.0
Republic	56	— 3	28.6	0.31	2.0
Rome	63	4	34.8	0.40	1.0
Russell	65	— 2	32.2	0.30	3.0
Salina	60	— 4	31.7	0.39	3.0
Sedan	61	3	34.8	0.53	T.
Seneca	54	— 2	30.0	0.23	2.0
Toronto	63	— 3	30.6	0.80	2.5
Valley Falls	54	— 6	30.3	0.64	7.0
Viroqua	75	4	35.6	0.11	1.0
Wakeeney				0.08	0.8
Wallace	70	4	34.0	0.15	1.5
Walnut	61	— 5	33.8	0.48	0.5
Wamego *1	54	— 2	30.6	0.47	4.7
Winfield	63	5	34.2	0.22	T.
Yates Center				0.07	0.7
Kentucky.					
Alpha	72	10	38.5	2.62	6.2
Anchorage	65e	1e	32.8e	2.31	2.5
Bardstown	67	6	34.8	2.85	3.0
Beattyville				3.08	7.3
Berea	71	3	34.8	2.01	2.0
Blandville	69	7	35.6	2.85	2.2
Bowling Green	70	9	36.0	2.64	
Burnside	73	9	34.8	2.75	0.5
Cadiz	71	10	36.2	1.95	
Carrollton	68	2	31.2	2.26	2.2
Catlettsburg	74	8	34.4	2.31	T.
Earlington	74	7	34.9	2.48	0.2
Edmonton	70	6	36.0	2.25	2.2
Eubank	72	2	34.3	3.04	2.2
Falmouth				2.47	3.0
Fords Ferry	69	6	35.2	2.73	T.
Frankfort	67	4	33.4	2.28	2.0
Franklin	72	13	37.7	1.44	1.4
Greensburg	70	8	33.4	2.69	1.5
Henderson	68	5	33.2	2.63	0.8
Highbridge	70	8	34.2	2.06	0.2
Hopkinsville	70	9	36.9	2.66	T.
Irvington	67	5	34.9	1.60	2.0
Jackson	77	8	38.4	2.37	
Leitchfield	67	6	33.6	2.55	1.5
Loretto	68	5	34.9	2.30	1.2
Manchester	72	2	36.0	2.90	4.0
Marrowbone c	71	5	35.2		
Mayfield	68	11	37.0	2.62	7.2
Maysville	69	4	33.2	2.64	4.5
Middlesboro	70	2	34.6	2.40	
Mount Sterling	68	5	33.0	2.41	2.0
Owensboro	66	6	35.4	2.58	1.0
Owenton	67	0	31.4	3.78	7.8
Paducah *a*				2.88	T.
Paducah *b*	71	10	38.2	3.20	T.
Pikeville	75	9	37.1	2.55	4.0
Princeton	70	5	35.3	2.60	3.5
Richmond	52e	7	32.0e	2.03	
St. John	66	5	33.6	2.44	0.5
Scott	64	— 2	30.4	1.82	4.4
Shelby City	69	3	34.0	2.37	1.5
Shelbyville	67	3	32.6	2.71	8.0
Taylorsville	68	1	32.8	2.46	3.5
Williamsburg	82	5	38.0	2.89	3.5
Williamstown	65	— 9	31.8	2.21	5.5
Louisiana.					
Abbeville	77	26	50.8	6.81	
Alexandria	82	22	46.9	5.61	T.
Amite	71	22	46.8	9.76	
Baton Rouge	74	25	48.4	8.22	
Burnside	73d	24d	50.8d	6.94	
Calhoun	76	17	42.9	2.77	
Cameron	69	32	50.9	4.51	
Cheneyville	79	25	48.1	4.97	0.2
Clinton		22		6.51	
Collinston	80	20	46.3	4.84	
Covington	74	23	48.3	7.64	
Donaldsonville	75	27	49.7	7.09	
Emilie	73	27	50.2	6.44	
Farmerville	77	18	41.4	2.54	
Franklin	75	27	50.4	6.66	
Grand Coteau	78	28	50.8	6.17	
Hammond	74			5.93	
Houma	77	29	50.2	5.92	
Jennings	77			5.70	
Lafayette	76	26	49.4	6.82	
Lake Charles	78	29	50.1	5.43	
Lake Providence	80	19	48.0	5.83	
Lakeside	75	32	49.8	5.28	
Lawrence	76	24	50.3	3.41	
Libertyhill	84			5.68	
Mansfield	84	19	46.4	3.44	
Melville	78	22	47.8	6.40	
Monroe	80	22	46.5	5.36	
New Iberia	76	32	52.6	5.20	
Opelousas	77	26	48.4	6.13	
Oxford	84	22	45.6		
Plain Dealing	80	18	45.3	3.34	
Port Eads	75	34	52.4	3.89	
Reserve	74	29	49.8	7.06	
Robeline	80	20	47.1	2.95	
Ruston	84	14	45.5	4.60	
Schriever	78	24	50.4	5.15	
Sugar Experiment Station	77	28	50.5	4.47	
Sugartown	76	25	49.4	4.89	
Venice	77	27	51.5	3.70	
Wallace	75	25	51.2	6.43	
Maine.					
Bar Harbor	47	10	28.6	5.83	11.5
Belfast	46	15	18.8	4.96	13.0
Cornish	45	13	21.2	4.54	17.2
Danforth				2.94	12.5
Fairfield	45	22	17.7	3.94	16.5
Farmington	44	22	16.8	3.61	23.5
Gardiner	48	22	17.9	4.54	15.0
Houlton	48	20	18.4	3.14	20.0
Jackman				2.32	18.0
Kineo				2.36	11.0
Lewiston	46	16	18.2	4.48	16.8
Maine—Cont'd.					
Mattawamkeag				3.57	10.0
Mayfield	39	17	17.4	5.48	17.0
Millinocket				3.34	9.0
North Bridgton	47	19	17.7	4.20	21.5
Orono	41	23	15.8	3.62	15.2
Patten	36	27	12.6	1.60	9.0
Rumford Falls	42	16	17.1	3.51	18.4
Solon				3.78	18.0
The Forks				2.30	22.0
Vanburen	36	37	6.6	2.70	30.0
Vanceboro	46	2	26.1	2.20	12.0
Winslow	43	24	16.8	4.14	17.2
Maryland.					
Annapolis	62			4.15	1.0
Bachmans Valley	50	6	29.0	6.08	13.0
Boettcherville	54	— 6	28.4	3.88	14.0
Cambridge	54	15	34.2	4.71	3.0
Chase	56	8	31.4	4.25	2.5
Cheltenham	59	10	32.8	3.67	1.8
Chestertown	54	11	32.0	3.78	0.8
Chewsville	51	1	29.3	3.95	9.0
Clearspring	50	5	28.6	5.07	10.8
Coleman	53	10	32.3	4.00	2.0
Collegepark	56	10	31.6	3.75	1.1
Colora				4.98	8.0
Cumberland				3.96	13.0
Darlington	52	7	30.2	4.60	3.5
Deerpark	56	— 5	24.8	4.65	20.0
Denton	64	12	32.6	2.30	2.0
Easton	55	12	33.6	3.61	2.5
Fallston	54	8	30.7	4.28	6.0
Frederick	53	8	31.9	4.24	8.5
Grantsville	53	— 6	24.1	3.60	15.5
Greatfalls	57	9	30.8	4.28	
Greenspring Furnace	51	0	29.6	3.85	8.5
Hancock	52	— 2	30.0	3.10	9.0
Harney				4.31	13.0
Jewell	59	10	33.8	3.53	1.0
Laurel	57	10	31.6	4.57	6.0
McDonogh	53e	7e	28.2e	4.63	
Mount St. Marys College	52	6	29.2	4.27	13.5
New Market	50	7	30.3	4.76	9.8
Pocomoke City	60e	14	37.2	2.88	
Prince Frederickton	60	10	33.8	3.77	3.0
Princess Anne	60	13	35.4	3.78	1.2
Queenstown	54	10	32.7	3.13	1.5
Sharpsburg	50	6	30.2	4.11	9.0
Solomons	56	15	34.6	3.05	3.4
Sudlersville	52	11	33.2	3.08	2.0
Takoma Park	55	9	30.6	5.20	
Van Bibber	55	10	31.9	4.61	
Westernport	49	3	28.8	2.73	12.5
Woodstock	54	9	33.0	3.69	6.6
Massachusetts.					
Amherst	46	12	24.2	3.28	9.0
Bedford	44	5	26.2	3.16	6.5
Bluehill (summit)	48	6	26.0	4.29	10.0
Cambridge	48	3	27.2	3.54	
Chestnuthill	47	3	28.2	3.95	7.0
Concord	49	6	25.0	3.16	5.4
East Templeton *1	46	10	23.5	2.75	7.8
Fall River	52	0	29.8	4.48	4.2
Fitchburg *a* *1	46	8	24.7	2.68	7.5
Fitchburg *b*	48	9	24.8	2.65	8.0
Framingham	50	7	27.0	3.77	4.5
Groton	45	12	23.8	2.90	11.0
Holyoke				3.16	8.0
Hyannis				4.18	5.0
Jefferson				2.84	6.8
Lawrence	48	6	24.8	3.31	8.5
Leominster				2.67	7.5
Lowell *a*	47	6	26.3	3.39	
Lowell *b*	50	8	25.9		
Ludlow Center	42	11	21.2	2.64	8.0
Middleboro	51	4	28.3	3.94	5.0
Monson	47	2	25.8	2.38	8.0
New Bedford *a*	49	1	28.8	4.77	10.8
Pittsfield				2.76	10.0
Plymouth *1	52	1	29.8	4.43	10.0
Princeton				2.39	6.5
Provincetown	50	2	31.4	4.15	2.5
Salem				3.77	9.5
Somerset *1	52	8	29.4	5.85	10.0
Sterling				2.66	5.8
Taunton	51	5	27.4	7.59	
Webster				3.30	5.2
Westboro	47	6	26.3	3.63	7.0
Weston	47	5	26.0	3.78	8.0
Williamstown	43	7	24.2	2.68	6.5
Winchendon				2.70	8.0
Worcester *b*	47	6	25.6	2.75	6.0
Michigan.					
Adrian	52			0.40	4.0
Agricultural College	48	7	20.7	1.20	12.0
Allegan	47e	1e	22.2e	2.82	16.0
Alma	45	5	21.1	1.99	12.0
Ann Arbor	50	7	22.2	1.27	7.3
Annpere	49d	6e	24.0d	1.38	7.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Arbela	49	— 5	22.6	2.95	11.5
Baldwin	42	— 7	20.9	2.10	9.0
Ball Mountain	48	— 7	22.2	1.04	9.4
Baraga	43	—11	14.5	0.50	5.0
Battlecreek	48	— 9	22.6	3.32	16.1
Bay City	46	0	22.0	1.58	6.0
Benzonia	45	5	22.5	2.79	26.9
Berlin	46	— 5	22.0	1.41	8.7
Berrien Springs	48	— 1	23.7	3.50	29.5
Big Rapids	42	— 5	19.4	2.66	20.5
Birmingham	48	— 7	22.6	0.99	6.9
Boon	40	— 5	17.8	2.34	17.5
Calumet	35	— 5	14.0	2.20	22.0
Carsonville	47	3	25.0	1.10	11.0
Caseville	.....	.....	.....	0.53	3.0
Cassopolis	51	— 7	21.4	4.45	27.5
Charlevoix	47	.....	.....	1.30	10.0
Charlotte[4]	48	— 8	22.2	.....	.....
Chatham	50	—17	15.9	2.45	19.5
Cheboygan	43	— 2	21.2	0.75	6.0
Clinton	54	— 8	24.0	1.14	7.0
Coldwater	52	— 8	25.2	1.10	6.0
Deerpark	38	— 7	19.2	2.94	26.0
Detour	40	— 7	19.4	2.35	14.0
Dundee	55	—10	23.6	1.15	11.5
Eagle Harbor	37	1	18.6	0.21	2.0
East Tawas	45	— 8	20.7	1.38	6.0
Eloise	52	— 9	22.8	1.08	9.8
Ewen	34	0	14.2	0.70	7.0
Fennville	44	4	24.0	2.93	20.6
Fitchburg	50	—10	22.0	3.13	10.0
Flint	48	— 4	21.5	1.51	9.0
Frankfort	44	8	25.8	1.20	12.0
Gaylord	42	— 2	18.0	1.65	16.5
Gladwin	37	— 2	16.6	3.05	16.5
Grand Marais	37	1	20.7	2.76	18.0
Grand Rapids	48	4	24.6	1.11	7.0
Grape	55	— 8	23.1	1.21	8.7
Grayling	45	— 2	19.4	3.30	28.5
Hagar	48	4	25.4	3.44	11.8
Hanover	51	—11	22.4	1.72	10.0
Harbor Beach	43	— 3	22.6	1.44	5.0
Harrison	36	— 5	15.2	1.91	15.0
Harrisville	42	— 8	19.6	2.08	12.2
Hart	40	2	21.7	1.21	12.0
Hastings	49	— 3	23.4	1.87	9.9
Hayes	48	— 8	20.1	1.88	11.5
Highland Station	.....	.....	.....	1.90	8.0
Hillsdale	52	—10	22.5	3.20	24.0
Humboldt	38	—32	12.0	0.50	5.0
Ionia	44[1]	— 6[1]	26.7[1]	.....	.....
Iron Mountain	44	—15	14.2	0.54	4.0
Iron River	36	—26	8.4	0.45	1.0
Ironwood	38	—13	12.8	2.00	20.0
Ishpeming[4]	42	—16	12.6	0.55	5.5
Ivan	41	2	19.6	2.55	21.0
Jackson	50	— 8	22.0	1.69	8.0
Jeddo	47	— 5	21.6	1.22	11.8
Kalamazoo	45	— 3	22.2	2.85	20.5
Lake City	41	0	21.1	2.10	20.0
Lansing	49	— 6	22.3	1.54	7.6
Lapeer	48	— 5	22.0	.....	.....
Lathrop	40	—18	16.0	3.00	5.0
Lincoln	49[d]	0[d]	20.5[d]	0.55	5.5
Ludington[1]	40	6	23.0	2.60	24.0
Mackinac Island	40	— 3	20.2	2.25	14.0
Mackinaw	40	— 1	20.5	1.60	12.0
Mancelona	42	4	21.8	3.90	36.0
Manistee	40[h]	5[m]	23.8[1]	1.80	13.0
Manistique	38	— 4	19.4	1.21	5.5
Menominee	45	—10	18.1	0.25	2.5
Midland	45	— 6	26.2	1.08	9.5
Mio	41	— 4	18.8	1.87	11.3
Montague	43	5	23.8	2.15	18.5
Mount Pleasant	45[d]	— 4[d]	20.5[d]	1.57	12.0
Muskegon	47	5	24.0	1.50	13.0
Newberry	41	6	22.9	1.55	15.5
Old Mission	40	8	21.0	2.00	11.5
Olivet	48	— 9	22.8	1.96	9.9
Omer	44	—11	19.4	1.50	7.5
Onaway	42	— 8	20.0	1.28	10.0
Ontonagon	37	— 9	17.4	2.45	24.5
Ovid	47	— 4	21.9	1.54	6.0
Owosso	.....	.....	.....	1.20	4.0
Petoskey[e]	42	4	20.5	1.52	15.5
Plymouth	53	2	25.0	.....	.....
Port Austin	42	— 2	22.5	0.87	5.0
Powers	47	— 10	15.2	.....	.....
Reed City	50[h]	2[f]	20.2[e]	1.90	14.0
Roscommon	52	— 8	19.8	1.84	18.0
Saginaw	48	1	23.0	2.11	12.5
St. Ignace	40	4	21.2	0.95	9.5
St. Johns	48	— 2	23.5	0.80	8.0
St. Joseph	49	1[d]	22.8[e]	2.41	23.0
Sidnaw	48	— 6	19.8	1.55	15.5
Slocum	45	— 4	21.6	1.23	6.3
Somerset	52[1]	— 4[1]	20.6[1]	1.00	10.0
South Haven	50	2	24.0	2.37	16.0
Thomaston	35	—15	11.4	0.70	7.0
Thornville	47	— 8	22.2	1.73	16.0
Traverse City	55	1	23.2	2.08	19.5
Vassar	47	— 7	23.8	1.70	8.2
Wasepi	49	— 9	23.0	2.24	13.5
Waverly	46	4	23.7	1.81	14.5
Webberville	49	— 7	22.7	3.06	9.0
West Branch	41	— 4	17.9	2.21	19.5
Wetmore	35	— 4	15.6	1.10	11.0
Whitecloud	48	.....	.....	2.20	13.0
Whitefish Point	43	— 2	20.2	1.53	14.8
Ypsilanti	52	—10	22.2	1.60	7.7
Minnesota.					
Ada	35	—28	8.8	0.54	6.5
Albert Lea	39	—12	13.8	0.20	2.0
Alexandria	38	—22	9.2	0.13	1.3
Angus	33	—34	2.4	.....	.....
Ashby	34	—21	10.2	0.41	4.6
Beardsley	42	—23	12.8	1.00	10.0
Beaulieu	35	—27	5.0	0.37	4.0
Bemidji	34	—22	8.1	0.65	.....
Bird Island	40	—15	13.2	0.59	5.8
Blooming Prairie	38	—12	15.5	0.55	5.5
Caledonia	38	—13	15.4	0.20	1.6
Collegeville	37	—16	14.1	0.22	2.6
Crookston	34	—28	6.6	0.65	6.5
Currie	42	—20	14.3	.....	.....
Deephaven	.....	.....	.....	0.05	1.0
Detroit	38	—37	4.6	0.72	6.0
Duluth (sub station)	33	—17	9.8	0.73	7.1
Faribault	38	—14	15.2	0.20	1.5
Farmington	36	—20	13.2	0.35	3.5
Fergus Falls	39	—24	10.7	0.46	4.6
Floodwood[e]	38	—26	7.8	0.40	4.2
Glencoe	40	—14	12.5	0.10	1.0
Grand Meadow	38	—14	14.6	0.46	4.5
Hallock	34	—38	2.6	0.94	7.8
Lake Winnibigoshish	33	—25	4.6	0.93	10.2
Leech	36	—28	4.5	0.96	9.9
Long Prairie	40	—22	10.4	0.18	0.8
Luverne	37	—11	17.2	0.32	3.2
Lynd	44	—13	16.6	0.57	5.2
Mapleplain	40	—18	12.0	0.42	4.5
Milaca	37	—23	9.6	0.20	2.0
Milan	40	—20	10.7	1.07	10.8
Minneapolis *b*[1]	40[g]	—15	13.3	0.24	2.5
Montevideo	42	—18	11.3	0.24	2.2
Morris	38	—20	11.1	0.31	3.1
Mount Iron	39	—23	5.4	1.15	11.5
New London	34	—19	8.6	0.17	2.0
New Richland	40	—12	16.2	0.50	5.0
New Ulm	45	—11	15.6	0.25	3.0
Park Rapids	33	—25	5.5	0.61	6.1
Pine River	38	—33	5.1	0.38	7.5
Pipestone	38	—14	15.2	0.33	1.4
Pleasant Mounds	42	—10	17.6	0.33	3.8
Pokegama Falls	36	—39	2.9	0.42	5.2
Redwing *a*	.....	.....	.....	0.22	2.0
Reeds	.....	.....	.....	0.15	3.5
Rolling Green	39	— 9	16.8	T.	T.
St. Cloud	37	—20	11.2	0.20	2.0
St. Peter	43	—12	18.2	0.15	2.6
Sandy Lake Dam	36	—26	5.0	0.69	6.8
Shakopee	38	—15	13.6	0.27	2.5
Tower	35	—28	4.8	0.80	8.0
Two Harbors	36	—21	11.0	0.61	9.0
Wabasha	42	—13	16.2	0.26	2.2
Willow River	37	—25	8.3	0.81	7.0
Winnebago City	43	—11	16.2	0.14	3.4
Winona	41	—10	17.2	0.07	1.0
Worthington	42	—12	17.3	0.28	3.8
Zumbrota[1]	38[g]	—17	15.3	.....	.....
Mississippi.					
Aberdeen	72	18	41.2	5.28	
Agricultural College	78	19	44.2	4.64	
Austin	75	19	42.8	5.40	T.
Batesville	75	17	42.2	4.67	
Bay St. Louis	72[d]	27[d]	49.6[d]	4.83	
Biloxi	70	27	50.6	4.83	
Booneville	76	16	39.8	4.74	
Brookhaven	75	22	44.6	6.15	
Canton	79	20	46.6	3.47	
Cleveland *c*	79	19	45.4	4.86	
Columbus	79	20	42.6	4.79	
Crystalsprings	77	22	44.8	5.08	
Edwards	80	22	48.0	4.27	
Fayette	78	21	46.0	6.35	
Fayette (near)	.....	.....	.....	4.43	
Greenville *a*	73	22	45.2	5.04	
Greenville *b*	77	23	44.0	4.73	
Greenwood	80	21	44.0	5.13	
Hattiesburg	76	21	47.8	5.53	
Hazlehurst	77	20	45.4	5.64	0.6
Hernando	73	18	41.4	.....	
Holly Springs	72	17	39.2	3.41	
Indianola *e*	78	20	45.6	3.72	
Jackson	66	21	45.2	.....	
Kosciusko	78	19	43.1	4.73	T.
Lake	76	18	42.5	5.78	
Lake Como	76	20	45.6	6.45	
Laurel	76	21	48.2	6.38	T.
Leakesville	80	20	47.2	4.63	
Louisville	79	16	44.6	4.92	
Macon	78	20	42.6	3.43	
Magnolia	75	21	47.6	8.18	
Natchez	81	25	49.8	4.20	
Nittayuma	79	21	43.8	5.81	
Okolona	76	18	41.3	5.52	
Patmos	.....	.....	.....	5.47	
Pearlington	75	23	50.0	4.67	
Pittsboro	79	16	43.8	4.72	
Pontotoc	76	16	42.6	5.33	T.
Poplarville	81	23	50.2	6.21	
Ripley	73	12	40.6	5.05	T.
Shoccoe	80	17	45.8	3.55	0.2
Stonington	.....	.....	.....	6.20	
Suffolk	75	21	48.0	5.63	
Swartwout	73	23	49.6	5.94	
Thornton	76	23	45.7	8.45	
Tupelo	78	18	41.9	5.66	
University	77	16	43.1	5.85	
Walnutgrove	83	20	45.2	4.44	
Watervalley	76	17	43.1	5.68	T.
Waynesboro	75	19	46.2	4.01	
Woodville	74	25	48.4	6.10	
Yazoo City	81	22	43.8	4.57	
Missouri.					
Appleton City	60	—11	31.6	0.86	5.4
Arthur	58	— 3	33.0	0.80	3.5
Avalon	52	— 5	29.4	0.75	0.5
Bethany	50	— 4	28.6	0.15	1.5
Birchtree	66	6	34.2	1.56	1.0
Boonville	.....	.....	.....	1.91	6.1
Brunswick	63	— 6	28.8	1.32	8.5
Carrollton	60	— 9	30.0	1.79	3.3
Caruthersville	73	14	39.4	3.45	T.
Conception	52	.....	.....	0.40	4.0
Darksville	60	— 5	29.3	1.46	11.1
Dean	65	4	36.0	1.36	T.
Desoto	65	— 3	33.2	1.43	6.5
Downing	.....	.....	.....	0.45	4.0
Edgehill	65	2	33.6	2.03	2.5
Edwards	67	— 1	33.4	1.41	5.0
Eightmile[d][f]	.....	— 6	29.6	1.09	7.2
Fairport	.....	.....	.....	0.20	2.0
Fayette	63	0	31.6	2.06	9.9
Fulton	66	— 5	31.2	1.83	8.0
Galena	.....	.....	.....	1.20	2.0
Gallatin[d][1]	56	— 1	30.0	0.50	4.2
Glasgow	63	— 1	29.6	1.62	10.5
Gorin	.....	.....	.....	0.58	4.4
Grant City	52	— 5	28.3	0.12	1.0
Halfway	70[a]	— 4[d]	35.2[d]	1.77	7.0
Harrisonville	56	— 5	28.8	1.19	6.0
Hazlehurst	.....	.....	.....	0.22	1.0
Hermann	.....	.....	.....	1.55	10.0
Houston	68	4	34.6	2.05	1.0
Huntsville	62	— 4	29.5	1.59	9.5
Ironton	64	4	33.4	1.45	2.8
Jackson	70	7	35.4	2.43	3.5
Jefferson City	64	— 1	30.5	1.69	7.8
Joplin	66	5	36.4	1.16	T.
Kidder	51	— 7	28.3	0.28	2.7
Koshkonong	67	7	36.2	2.10	0.7
Lamar	62	— 3	34.6	0.85	2.0
Lamonte	.....	.....	.....	1.44	8.0
Lebanon	66	— 1	32.8	1.45	1.5
Lexington	59	— 2	31.0	0.97	5.5
Liberty	53	— 5	29.6	0.45	4.5
Louisiana	60	— 4	29.0	1.97	11.8
Macon	61	— 5	29.0	1.46	7.0
Marblehill	68	5	34.8	1.48	1.5
Marshall	62	— 5	29.9	1.69	8.0
Maryville	50	— 5	25.3	0.30	2.8
Mexico	67	— 4	29.5	2.31	12.6
Miami[d][f]	59	— 4	29.2	1.16	7.5
Mineralspring	63	5	34.9	2.35	1.0
Monroe City	63	— 9	27.6	2.13	13.1
Montreal	69	— 9	32.2	1.82	6.2
Mountaingrove	65	2	33.6	1.81	0.5
Mount Vernon	68	4	35.9	1.08	T.
Neosho	65	1	35.8	1.60	1.0
Nevada	.....	.....	.....	1.25	5.0
New Haven	71	0	32.8	2.10	13.0
New Madrid *b*	.....	.....	.....	3.31	0.8
New Palestine	64	— 3	32.2	1.42	7.4
Oakfield	66	— 2	32.6	1.74	11.5
Olden	70	7	35.2	1.88	0.0
Palmyra[d][f]	52	— 6	26.8	1.97	11.5
Pine Hill	.....	.....	.....	0.53	1.4
Poplarbluff	.....	.....	.....	2.20	0.5
Princeton	50	— 6	26.8	0.27	1.5
Protem	69	9	38.4	1.51	0.4
Richmond	.....	.....	.....	0.65	6.5
Rockport	.....	.....	.....	0.06	0.5
Rolla	.....	.....	.....	1.82	2.6

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Charles	65	— 2	32.0	1.94	9.0
St. Joseph	.....	.....	....	0.24	2.5
Sarcoxie	.....	.....	.....	0.97	T.
Sedalia	62	— 6	31.2	1.37	9.0
Seymour	64	— 1	33.0	1.49	1.0
Shelbina	.....	.....	.....	1.15	7.0
Sikeston	70	10	36.6	2.45	T.
Steffenville	55	— 6	28.2	1.39	9.0
Subiett	52	— 6	26.3	1.65	4.0
Trenton	49	— 3	28.4	0.36	2.5
Unionville	50	— 6	26.0	0.48	1.5
Vichy	70	— 5	32.4	2.26	6.5
Warrensburg	60	— 5	32.2	1.68	10.1
Warrenton	67	— 2	29.9	1.70	7.2
Wheatland	.....	.....	.....	1.77	4.2
Willowsprings	68	4	33.6	1.80	T.
Windsor	61	— 7[e]	32.4[e]	1.04	4.5
Zeitonia	56[b]	5[g]	32.0[b]	1.36	T.
Montana.					
Adel	51	—15	26.5	0.70	7.0
Anaconda	52	1	25.5	0.85	.....
Augusta	63	—14	31.0	0.19	1.5
Billings	59	0	31.2	.....	.....
Boulder	48	— 2	25.3	0.45	2.0
Bozeman	50	— 2	26.2	0.78	.....
Butte	49	5	27.2	0.42	4.2
Canyon Ferry	55	— 9	25.5	0.57	5.0
Columbia Falls	49	5	27.2	1.75	1.5
Crow Agency	55	—10	27.8	0.50	3.0
Culbertson	40	—21	11.8	0.23	2.0
Deerlodge	51	— 7	22.6	0.05	0.5
Dillon	49	1	27.6	0.82	8.2
Ekalaka	50	—18	23.3	0.40	4.0
Fort Benton (*a*)	50	— 4	26.3	0.10	1.0
Fort Logan	50	—10	25.8	0.12	1.2
Glasgow	.....	.....	.....	0.17	.....
Glendive	46	—30	16.2	1.32	13.0
Greatfalls	56	— 2	31.8	0.08	0.7
Hamilton	54	7	30.0	1.08	3.5
Kipp	50	—18	23.1	0.30	3.0
Lamedeer	60	—19	29.6	.....	5.0
Lewistown	50	0	27.9	0.47	4.8
Livingston	52	— 7	24.1	0.25	0.5
Marysville	42	— 6	23.8	3.04	17.5
Missoula	46	— 2	24.6	0.90	5.5
Parrot	52	5	29.2	0.37	3.7
Plains	46	13	29.0	0.35	1.0
Poplar	40	—23	13.4	T.	T.
Redlodge	57	— 5	26.8	0.44	1.2
St. Pauls	51	— 5	26.4	0.50	5.0
St. Peter	52	—11	29.5	0.50	5.0
Springbrook	44	—22	17.2	1.23	10.9
Summit	54	—12	24.6	8.50	68.0
Toston	51	— 3	26.3	0.11	1.1
Troy	55	6	29.2	4.50	13.5
Twin Bridges [e]	54	— 7	24.3	.....	.....
Twodot	50	5	25.6	0.70	5.0
Utica	52	3	29.9	0.50	5.0
Winston	55	2	26.4	0.63	6.1
Yale	48	— 2	27.1	0.65	6.5
Nebraska.					
Agate	54	— 2	26.6	0.24	2.5
Agee [*1]	44	—14	19.6	0.15	1.5
Albion	59	— 7	25.8	0.00	
Alliance	53	— 5	27.4	0.05	0.5
Alma	54	— 7	28.0	0.43	4.0
Ames	51	— 2	27.5	0.02	T.
Ansley	54	— 6	25.7	0.62	6.2
Arapahoe	.....	.....	.....	0.20	2.0
Arcadia	.....	.....	.....	0.40	4.0
Ashland *a*	52	— 1	27.4	T.	T.
Ashton	.....	.....	.....	0.24	3.0
Auburn	53	— 4	29.0	0.08	0.4
Aurora	63	0	28.8	0.10	1.0
Bartley	.....	.....	.....	0.25	2.0
Beatrice	53	— 7	28.1	0.10	1.0
Beaver	58	— 4	29.8	0.25	1.5
Bellevue	.....	.....	.....	0.31	3.1
Benedict	.....	.....	.....	T.	T.
Benkleman [*1]	50	4	29.0	0.50	3.0
Blair	49	— 4	23.4	0.05	T.
Bluehill [*1 h]	48	8	28.4	0.10	1.0
Bradshaw	.....	.....	.....	0.12	0.6
Bridgeport	61	0	29.8	0.30	3.0
Brokenbow	52	— 9	26.6	0.24	3.5
Burchard	.....	.....	.....	T.	T.
Burwell	.....	.....	.....	0.20	2.0
Callaway	54	— 8	24.1	0.45	4.0
Cedar Rapids	54	— 4	24.0	0.06	0.6
Central City	.....	.....	.....	T.	T.
Chester	.....	.....	.....	0.35	3.5
Cody	.....	.....	.....	0.30	3.0
Columbus	51	— 2	25.2	T.	T.
Crete	54	— 7	27.8	0.37	2.5
Culbertson	.....	.....	.....	0.30	3.0
Curtis	56[f]	— 7[f]	28.6[f]	0.30	3.0
Dawson	58	— 3	29.2	0.07	0.4
Edgar	.....	.....	.....	0.22	2.2
Ericson	.....	.....	.....	0.30	3.0
Ewing	.....	.....	.....	0.25	2.5
Fairbury	56	— 4	27.0	0.20	2.3
Fairmont	53	— 8	25.0	0.15	1.5
Fort Robinson	55	— 2	29.2	0.60	6.0
Franklin	59	— 8	27.5	0.20	2.0
Fremont	51	— 4	23.8	T.	T.
Fullerton	.....	.....	.....	0.05	0.5
Geneva	56	— 9	26.3	0.30	3.0
Genoa (near)	50	— 3	26.0	T.	T.
Gering	59	5	31.6	0.30	1.0
Gordon	.....	.....	.....	0.80	8.0
Gosper	.....	.....	.....	0.30	3.0
Gothenburg	59	— 6	26.7	0.40	4.0
Grand Island *b*	55	— 5	27.2	0.20	2.0
Greeley	.....	.....	.....	0.10	1.0
Guide Rock	.....	.....	.....	0.30	3.0
Haigler	.....	.....	.....	0.20	2.0
Hartington	45	—12	21.5	0.00	0.0
Harvard	54	— 5	26.5	0.20	2.0
Hastings [*1]	52	— 6	27.1	0.20	2.0
Hayes Center	.....	.....	.....	0.28	2.8
Hay Springs	47	—12	23.6	0.48	4.9
Hebron	54	— 1	28.0	0.16	2.2
Hickman	.....	.....	.....	0.20	2.0
Holbrook	.....	.....	.....	0.40	3.1
Holdrege	50	5	28.2	0.20	2.0
Hooper [*1]	46	— 2	24.7	T.	T.
Imperial	60	— 4	31.3	0.22	2.2
Johnstown	.....	.....	.....	0.35	3.5
Kearney	57	— 5	29.0	0.22	2.2
Kennedy	50	—12	26.8	0.70	7.0
Kimball	55	2	29.2	0.15	1.5
Kirkwood	46[c]	— 4[c]	23.1[c]	0.18	1.8
Laclede	53	— 4	26.2	T.	T.
Lexington	59	— 6	27.6	0.35	3.5
Lodgepole	62	0	30.1	T.	T.
Loup	60	— 8	28.1	0.20	3.0
Lynch	47	—12	20.2	0.13	1.4
Lyons	.....	.....	.....	0.02	0.2
McCook [*1]	54	0	32.1	0.10	1.0
McCool Junction	.....	.....	.....	0.05	.....
Madison	46	— 5	23.7	T.	T.
Madrid	58	— 6	27.8	0.20	2.0
Marquette	.....	.....	.....	0.15	1.5
Mason	.....	.....	.....	0.40	4.0
Minden *b*	55	— 6	27.4	0.33	3.0
Nebraska City *c*	51	— 3	28.7	T.	T.
Nemaha	.....	.....	.....	T.	T.
Norfolk	52	— 8	21.9	0.14	T.
North Loup	60	— 8[b]	23.8[b]	0.30	2.5
Oakdale	51	— 9	22.0	0.06	0.6
Odell	.....	.....	.....	0.20	1.0
O'Neill	49	—14	22.0	0.35	3.5
Ord	.....	.....	.....	0.22	.....
Osceola	.....	.....	.....	0.01	0.1
Palmer	.....	.....	.....	0.20	2.0
Palmyra [*1]	54	— 8	26.9	T.	T.
Pawnee City	.....	.....	.....	0.17	0.6
Plattsmouth *b*	52	— 2	26.5	T.	T.
Purdum	53[c]	—14[c]	25.4[c]	0.36	3.9
Ravenna *a*	59	— 6	27.2	0.37	3.7
Ravenna *b*	.....	.....	.....	0.40	4.0
Redcloud	60	— 3	27.3	0.30	3.0
Republican [*1]	48	— 4	28.5	0.25	2.5
Rulo	.....	.....	.....	0.02	0.2
St. Libory	.....	.....	.....	0.20	2.0
St. Paul	55	— 4	28.4	0.11	1.0
Salem [*1]	.....	.....	.....	0.10	1.0
Santee	47	— 8	23.0	0.12	1.8
Seward	55	.....	.....	0.02	0.2
Smithfield	.....	—10	.....	0.30	3.0
Springview	.....	.....	.....	0.20	2.0
Stanton	52	— 6	24.0	T.	T.
State Farm	54	— 5	27.8	0.13	1.2
Strang [*1]	54	— 4	30.2	0.15	1.5
Stratton	.....	.....	.....	0.28	2.0
Superior	55	— 3	26.0	0.20	2.0
Syracuse	.....	.....	.....	0.10	1.0
Tablerock	50	— 2	26.4	0.02	T.
Tecumseh *b*	48	— 3	28.8	.....	.....
Tekamah	59	— 4	26.8	0.03	T.
Turlington	51	— 5	27.6	0.19	1.5
Wakefield	48	— 7	23.9	0.01	0.1
Weeping Water	.....	.....	.....	0.28	1.5
Westpoint	50	— 4	23.9	T.	T.
Wilber [*1]	52	— 8	28.7	0.20	2.0
Wilsonville	.....	.....	.....	0.20	2.0
Winnebago	55[h]	— 8	28.8[h]	T.	T.
Wymore	.....	.....	.....	0.02	T.
York	54	3	29.0	0.00	
Nevada.					
Amos	53	—15	27.5	.....	.....
Austin	54	2	31.8	1.80	15.0
Battle Mountain	60	0	34.7	1.35	9.0
Beowawe [*1]	60	4	33.7	1.37	6.0
Belmont	50	— 1	28.7	0.76	9.0
Candelaria	61	11	38.0	0.61	6.0
Carlin [*1]	44	0	27.6	1.55	14.0
Carson City	60	— 6	34.3	2.86	11.8
Cranes Ranch	.....	.....	.....	1.91	.....
Elko	47	— 3	27.4	6.00	3.0
Ely	54	—13	28.2	0.75	7.0
Eureka	59	0	31.5	1.00	10.0
Fenelon [*1]	45	4	26.6	.....	.....
Golconda [*1]	52	9	31.0	1.70	18.5
Halleck [*1]	58	0	28.6	1.95	16.5
Hawthorne	65	10	36.4	1.10	2.0
Humboldt	61	7	33.0	1.72	14.0
Lee	.....	.....	.....	4.07	18.0
Lewers Ranch	59	3	37.2	7.40	31.0
Lovelocks	52	2	34.2	0.50	5.0
Martins	66	— 8	36.1	2.23	8.0
Mill City [*1]	63	7	34.0	.....	.....
Morey	57	— 4	33.2	1.69	17.0
Palisade	59	— 2	30.2	1.69	7.0
Palmetto	65	4	33.4	1.00	10.0
Potts	55	—16	28.3	0.84	8.5
Reno State University	59	— 3	34.2	3.00	11.5
Rioville	72	23	47.1	0.11	.....
Sodaville	61	9	35.2	0.76	2.0
Tecoma	50	0	28.6	0.77	6.0
Toano [*b]	46	0	24.2	2.68	11.5
Wabuska	65	— 4	31.7	.....	.....
Wadsworth	63	4	31.8	1.43	5.0
Wells [*1]	51	1	27.3	2.00	16.0
Wood	53	1	28.5	3.77	7.0
New Hampshire.					
Alstead	40	—13	22.7	3.13	10.8
Berlin Mills	42	—30	15.6	2.41	14.2
Bethlehem	44	—21	16.8	2.73	9.5
Brookline [*1]	46	—20	24.7	1.90	11.2
Chatham	46	—27	16.0	2.85	21.0
Concord	48	—22	20.7	3.44	10.2
Durham	49	—11	23.8	6.05	12.0
Franklin Falls	44	—14	20.4	3.88	13.2
Grafton	48	—26	17.6	3.36	14.0
Hanover	43	—24	18.3	3.03	10.8
Keene	45	—17	21.7	2.73	7.0
Littleton	34	—17	15.3	2.61	19.0
Manchester	.....	.....	.....	3.39	.....
Nashua	48	—10	24.0	3.05	8.8
Newton	50	—11	23.6	3.63	8.0
North Stratford	.....	.....	.....	2.69	.....
Peterboro	46	—15	21.6	3.03	5.5
Plymouth	42	—23	18.2	3.92	21.9
Sanbornton	44	—15	18.6	3.15	8.5
Sewalls Falls	.....	.....	.....	3.59	11.4
Stratford	45	—28	15.3	2.38	13.6
West Stewartstown	.....	.....	.....	3.04	20.6
New Jersey.					
Asbury Park	51	9	32.6	4.67	5.0
Barnegat	57	8	33.0	4.86	4.0
Bayonne	51	8	29.8	3.79	4.5
Belvidere	48	5	27.6	4.54	8.0
Bergen Point	50	8	29.5	4.40	7.4
Beverly	52	9	31.4	3.77	7.0
Blairstown	47	4	26.8	3.45	7.0
Bridgeton	55	10	33.2	3.58	3.0
Camden	52	10	32.3	4.07	5.5
Canton	.....	.....	.....	3.12	2.7
Cape May C. H.	57	9	33.5	3.81	3.7
Charlotteburg	50	— 3	26.7	4.89	6.0
Chester	50	2	26.5	4.79	8.0
Clayton	55	9	31.7	3.09	9.0
College Farm	50	8	29.8	3.84	7.0
Culvers Lake	.....	.....	.....	3.49	8.6
Dover	49	3	25.8	4.79	9.0
Egg Harbor City	54	8	33.0	4.62	4.0
Elizabeth	50	8	30.0	3.93	9.0
Englewood	56	5	30.8	3.97	.....
Flemington	54	8	29.4	4.33	6.5
Freehold	51	7	30.4	4.86	.....
Friesburg	54	10	31.8	3.12	2.0
Hightstown	50	8	31.2	3.66	8.5
Imlaystown	52	8	31.8	3.62	6.1
Indian Mills	55	7	32.4	3.60	5.0
Lakewood	52	8	31.8	4.44	7.0
Lambertville	51	8	29.9	4.25	7.8
Layton	49	— 5	24.3	2.31	8.0
Moorestown	53	9	31.8	3.69	5.7
Mount Pleasant	.....	.....	.....	2.47	T.
Newark	53	8	29.0	4.26	5.5
New Brunswick	50	7	30.2	4.15	7.6
Newton	52	1	25.4	4.39	15.0
Oceanic	51	8	31.6	4.24	6.0
Paterson	54	9	30.8	5.04	6.2
Pemberton	53	9	31.2	3.78	6.2
Plainfield	51	8	28.8	4.05	7.9
Rancocas	.....	.....	.....	4.55	6.1
Ringwood	54	3	27.3	3.67	.....
Rivervale	33	4	29.2	4.50	12.0
Roseland	.....	.....	.....	4.26	8.5
Somerville	51	8	29.0	4.09	10.0
South Orange	52	7	28.3	4.58	7.5
Sussex	50	0	25.8	3.43	11.2

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Three Bridges	.....	.....	.....	5.34	6.5
Toms River	55	7	32.3	4.49	6.0
Trenton	53	11	34.3	2.30	3.0
Tuckerton	55	7	32.7	4.55	4.5
Vineland	57	10	32.8	3.65	4.0
Woodbine	57	6	33.1	4.66	3.2
Woodstown	.....	.....	.....	3.67	3.2
New Mexico.					
Alamagordo	68	17	41.2	0.30	3.0
Albert	71	15	39.1	T.	T.
Albuquerque	70	11	36.3	0.08	1.5
Alma	67	10	38.1	0.01	
Arabella	72	10	40.8	0.22	3.0
Bellranch	.....	.....	.....	T.	T.
Bluewater	54	0	28.2	0.10	1.0
Cambray	.....	.....	.....	0.74	
Carlsbad	79	13	45.2	0.33	2.5
Deming	.....	.....	.....	0.49	3.0
Dorsey	62	6	31.4	T.	T.
Eagle Rock Ranch	60	2	31.1	0.24	3.4
Fort Bayard	63	17	38.0	0.78	0.2
Fort Stanton	65	7	33.6	0.36	3.6
Fort Union	64	4	34.6	T.	T.
Fort Wingate	53	10	32.8	0.46	4.6
Fruitland	55	8	30.6	0.09	0.3
Gage	.....	.....	.....	0.27	0.0
Galisteo	52	5	28.9	0.10	1.0
Gallinas Spring	66	10	36.6	0.10	2.0
Hot Springs	65	11	35.0	T.	T.
Las Vegas	62	7	33.4	0.07	1.0
Lordsburg	.....	.....	.....	0.00	0.0
Mesilla Park	71	12	41.8	0.20	2.0
Mountainair	58[a]	8	33.5[a]	0.60	3.0
Roswell	80	10	42.8	0.22	2.0
San Marcial	72	15	39.2	0.05	0.5
Strauss	.....	.....	.....	0.50	5.0
Taos	56	−1	23.8	0.25	T.
Winsors Ranch	55	1	26.8	T.	T.
New York.					
Adams	.....	.....	.....	4.54	45.5
Addison	47	−4	24.6	1.87	11.0
Adirondack Lodge	43	−38	16.2	4.35	28.7
Akron	.....	.....	.....	2.78	.....
Alden	51	−8	25.6	2.40	23.9
Angelica	50	−11	23.4	1.78	17.7
Appleton	51	2	25.6	2.68	.....
Arcade	44	−11	20.8	3.51	29.1
Athens	46	−7	24.2	2.83	11.4
Atlanta	45	−9	22.6	2.41	12.3
Auburn	45	−2	24.9	0.89	9.9
Avon	49	−6	23.6	1.83	9.0
Axton	41	−36	15.4	3.92	40.5
Baldwinsville	46	−7	23.8	3.09	19.5
Bedford	48	1	26.2	2.33	5.4
Blue Mountain Lake	.....	.....	.....	3.40	29.5
Bolivar	48	−11	22.4	2.85	17.0
Bouckville	42	−11	20.7	3.60	23.0
Boyds Corner	.....	.....	.....	4.52	.....
Brockport	47	−2	24.6	2.41	16.5
Caldwell	42	−18	20.4	3.95	12.9
Canajoharie	44	−14	20.1	2.32	11.1
Carmel	49	−2	26.2	4.81	11.7
Carvers Falls	42	−26	19.3	2.71	12.0
Cedarhill	44	−9	23.2	2.29	6.7
Chazy	46	−20	16.8	3.22	14.0
Cooperstown	44	−8	21.7	3.30	16.0
Cortland	.....	.....	.....	1.70	.....
Cutchogue	50	7	30.7	4.80	4.0
Dekalb Junction	.....	.....	.....	3.93	23.0
De Ruyter	42	18	21.6	.....	.....
Easton	.....	.....	.....	2.91	15.0
Elba	48	−11	22.4	3.97	23.5
Elmira	49	0	26.6	2.08	.....
Fayetteville	48	−10	24.2	2.33	15.0
Franklinville	46	−12	22.2	3.12	19.0
Gansevoort	.....	.....	.....	3.09	16.5
Glens Falls	44	−11	21.8	3.53	13.1
Gloversville	40	−16	20.2	3.92	16.5
Greenwich	44[a]	−16[a]	20.1[a]	2.15	12.5
Griffin Corners	46	−10	20.8	2.60	11.4
Harkness	47	−18	19.4	1.88	15.4
Haskinville	.....	.....	.....	1.68	4.0
Hemlock	45	2	25.7	1.92	7.2
Honeymead Brook	47	−2	24.7	2.84	10.6
Indian Lake	44	−29	16.8	3.38	28.6
Ithaca	47	1	25.0	2.19	14.3
Jamestown	52	−6	24.0	2.90	19.5
Keene Valley	49	−22	20.0	2.79	11.8
King Ferry	.....	.....	.....	2.91	13.6
Liberty	42	−6	20.2	2.71	.....
Littlefalls, City Res.	45	−13	19.7	2.32	12.5
Lockport	50	−1	25.0	2.65	15.3
Lowville	44	−27	18.2	5.29	33.0
Middletown	49	1	26.6	2.57	7.3
Mohonk Lake	.....	.....	.....	3.13	16.0
Mount Etrick	47	−3	21.8	.....	.....
Newark Valley	.....	.....	.....	2.82	17.5
New Lisbon	44	−15	20.2	2.88	15.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
North Hammond	.....	.....	.....	2.35	21.4
North Lake	.....	.....	.....	2.02	18.0
Number Four	44	−30	18.2	6.16	48.4
Nunda	50	−8	25.7	1.04	6.7
Ogdensburg	44	−19	16.4	2.78	11.6
Oneonta	46	−6	23.4	2.46	9.0
Otto	53	−2	23.2	2.06	.....
Oxford	44	−8	20.8	3.92	21.1
Palermo	.....	.....	.....	3.19	13.8
Penn Yan	44	4	24.5	1.46	4.7
Perry City	45	−2	23.4	2.28	9.3
Plattsburg	47	0	21.2	2.50	6.0
Port Jervis	49	−2	25.4	3.00	6.0
Primrose	51	4	28.0	4.25	7.0
Redhook	.....	.....	.....	3.34	8.0
Richmondville	47	−7	22.0	1.78	4.5
Ridgeway	50	−5	24.6	2.78	16.2
Rome	40	−10	22.2	3.29	26.0
Romulus	46	4	25.2	1.56	13.0
Salisbury Mills	.....	.....	.....	3.50	.....
Saranac Lake	43	−24	17.3	3.26	21.9
Saratoga Springs	41	−25	20.7	4.26	14.5
Setauket	51	8	30.5	3.83	4.5
Shortsville	50	−1	25.2	2.12	3.4
Skaneateles	.....	.....	.....	3.75	.....
Southampton	49	8	31.2	3.75	4.5
South Butler	44	−5	23.6	3.66	19.0
South Canisteo	49	−11	22.4	3.25	24.0
Southeast Reservoir	.....	.....	.....	4.83	.....
South Kortright	48	−8	21.7	2.55	8.9
South Schroon	46	−19	18.3	3.49	24.0
Speer Falls	43	−18	21.2	3.36	.....
Straits Corners	43	−4	22.0	2.55	16.5
Ticonderoga	44	−17	21.4	3.27	19.0
Volusia	49	−5	23.1	2.18	.....
Walton	44	−5	22.8	2.72	20.8
Wappinger Falls	48	−1	25.2	3.56	8.0
Warwick	.....	.....	.....	2.88	.....
Watertown	48	−19	21.4	5.01	28.0
Waverly	48	−5	24.9	2.52	14.8
Wedgwood	44	−3	22.1	3.29	16.7
Wells	45	−29	19.8	1.50	.....
West Berne	47	−11	22.4	2.07	7.0
Westfield *b*	52	−5	25.2	1.27	.....
Westfield *c*	.....	.....	.....	1.75	9.5
Windham	48	−8	23.7	1.85	8.4
Youngstown	.....	.....	.....	1.89	8.0
North Carolina.					
Biltmore	63	11	36.2	1.63	
Brevard	61	7	32.6	4.30	1.0
Brewers	65	8	36.6	5.63	1.0
Bryson City	.....	.....	.....	2.45	0.8
Chapelhill	67[d]	17[e]	40.0[d]	4.06	
Cranberry	55	2	32.8	3.80	8.2
Currituck	.....	.....	.....	3.78	
Edenton	70	20	44.3	2.95	
Fayetteville	69	18	43.6	5.08	
Goldsboro	70	19	42.5	2.57	
Graham	.....	.....	.....	4.30	0.6
Greensboro	64	15	37.4	4.30	T.
Henderson	64	16	39.8	3.01	
Hendersonville	67	10	38.5	4.24	T.
Henrietta	65	15	40.9	5.45	
Highlands	58	2	31.5	5.33	3.0
Horse Cove	60	8	36.2	4.98	0.8
Hot Springs	69	12	39.2	.....	
Jefferson [1]	62	7	35.1	2.08	4.6
Kinston	71	18	43.0	2.96	
Lenoir	64	10	36.6	5.06	
Lexington	71	14	40.0	3.41	
Linville	56	1	30.4	3.16	3.0
Littleton	63	15	38.6	2.81	T.
Louisburg	65	17	40.2	2.69	T.
Lumberton	67	21	42.0	3.15	
Marion	65	10	38.7	5.07	1.5
Mocksville	.....	.....	.....	3.62	
Moncure	69	14	40.2	3.02	
Monroe	69	10	39.5	3.03	T.
Morganton	63	17	38.8	4.91	
Mountairy	62	13	36.4	5.17	1.0
Murphy	.....	.....	.....	2.53	.....
Newbern	72	20	45.4	4.48	
Patterson [2]	56	11	33.5	4.96	1.0
Penelo	68	19	42.4	3.25	
Pittsboro	68	13	41.8	3.19	T.
Reidsville	62	14	38.0	4.38	1.5
Rockingham	73	17	42.5	2.91	
Roxboro	62	14	37.5	4.00	T.
Salem	63	15	37.4	4.15	1.0
Salisbury	.....	.....	.....	3.75	
Saxon	65	12	36.6	4.64	
Selma	68	17	40.8	5.31	
Settle	68	16	38.0	5.66	T.
Sloan	72	20	46.4	4.58	
Soapstone Mount	67	11	38.6	3.84	T.
Southern Pines *a*	69	17	42.8	3.21	
Southern Pines *b*	69	18	42.8	2.88	
Southport	66	21	47.0	4.35	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Springhope [3]	65	20	42.9	2.49	
Statesville	65	13	38.8	6.43	T.
Tarboro	69	20	43.4	3.38	
Washington	73	21	46.0	2.97	T.
Waynesville	68	8	37.4	1.73	
Weldon *a*	64	20	39.2	2.46	
Weldon *b*	.....	.....	.....	2.42	
North Dakota.					
Amenia	42	−26	8.6	1.00	9.8
Ashley	45	−25	12.0	0.50	5.0
Berlin	46	−30	9.0	1.64	16.4
Bottineau	36	−28	6.6	0.50	5.0
Buxton	40	−25	9.0	0.76	7.6
Cando	36[c]	−37[d]	1.2[d]	0.34	3.4
Churchs Ferry	43	−28	5.8	0.66	6.6
Coalharbor	41	−20	12.1	0.73	7.3
Devils Lake	35	−30	5.7	1.08	10.8
Donnybrook	.....	.....	.....	0.13	1.3
Dunseith	40	−31	4.6	0.50	5.0
Edgeley	46	−21	11.8	0.76	7.6
Elbowoods	39	−19	9.7	.....	5.0
Ellendale	44	−20	11.6	0.70	7.0
Fargo	46	−30	7.0	0.83	8.3
Forman	36	−25	8.4	0.75	7.5
Fort Yates	56	−21	17.7	0.29	2.9
Fullerton	43	−24	10.4	0.88	8.8
Gallatin	38	−31	6.6	0.93	9.3
Glenullin	49	−14	17.0	0.91	9.3
Grafton	38	−28	5.2	1.05	10.5
Hamilton	35	−30	3.0	0.86	9.1
Hannaford	38	−31	7.7	0.93	9.3
Jamestown	42	−24	9.0	1.16	9.9
Larimore	41	−29	6.3	0.65	6.5
McKinney	40	−27	6.3	T.	T.
Mayville	38	−24	7.6	0.24	2.4
Medora	50	−29	18.4	0.85	8.5
Melville	40	−21	11.3	0.34	3.4
Minnewaukon	42[c]	−26[c]	8.2[c]	T.	T.
Minot	43	−23	13.0	0.20	2.0
Napoleon	45	−18	13.0	0.60	5.5
New England	48	−18	16.2	0.25	2.5
Oakdale	50	−18	18.2	1.45	14.5
Pembina	39	−31	2.4	0.53	5.3
Portal	38	−25	7.2	0.30	3.0
Power	40	−26	7.8	0.70	7.0
Steele	39	−23	10.8	0.60	6.0
University	48	−27	8.4	0.70	7.0
Valley City	42	−25	7.4	0.86	8.6
Wahpeton	41	−23	12.6	0.09	0.9
Willow City	40	−32	5.8	.....	.....
Ohio.					
Akron	59	−7	25.9	2.59	16.5
Annapolis	43[c]	0	25.0[c]	2.53	.....
Atwater	.....	.....	.....	2.25	12.0
Bangorville	57	−12	24.6	2.75	15.0
Bellefontaine	57	−10	26.8	2.16	10.5
Bement	.....	.....	.....	1.56	2.0
Benton Ridge	60	−7	26.0	1.89	11.5
Bethany	60	−5	29.4	2.99	7.0
Bladensburg	60	−6	25.8	3.68	10.3
Blaine	.....	.....	.....	2.78	12.5
Bloomingburg	.....	.....	.....	2.26	7.0
Bowling Green	59	−8	24.4	1.75	12.0
Bucyrus	60	−7	24.5	2.00	13.0
Cambridge	63	−8	28.5	2.69	8.0
Camp Dennison	66	0	30.1	2.50	5.5
Canal Dover	60	−3	27.0	2.56	8.5
Canton	57	−4	26.5	2.46	9.0
Cardington	59	−9	25.2	2.34	16.3
Cedarville	.....	.....	.....	2.68	11.0
Centerburg	.....	.....	.....	2.95	14.0
Circleville	16	−1	29.5	2.57	12.0
Clarksville	67	−3	29.4	2.25	4.5
Cleveland *a*	59	−5	27.8	2.05	11.4
Clifton	61	−5	27.4	1.97	7.0
Coalton	70	−6	31.4	2.69	8.0
Colebrook	55	−6	24.4	.....	.....
Coolville	.....	.....	.....	2.47	4.5
Coshocton	.....	.....	.....	2.82	6.7
Dayton *a*	.....	.....	.....	2.90	17.0
Dayton *b*	62	−4	28.2	2.39	14.5
Defiance	59	−8	24.8	1.15	10.0
Delaware	60	−7	26.0	2.47	14.5
Demos	61	−2	28.8	2.20	9.5
Dunham	.....	.....	.....	2.75	6.0
Dunkirk	.....	.....	.....	1.76	11.5
Elyria	50	−6	24.6	1.60	.....
Findlay	60	−8	25.9	1.23	9.0
Fort Recovery	.....	.....	.....	1.73	8.4
Frankfort	65	0	29.6	2.59	4.0
Fremont	58	−6	26.0	1.22	8.7
Galligher	.....	.....	.....	3.16	11.7
Garrettsville	57	−6	24.9	2.97	17.7
Granville	61	−4	27.2	2.66	14.0
Gratiot	61	−3	26.6	2.71	12.5
Green	70	4	33.4	3.28	9.5
Greenfield	65	−1	30.2	2.75	7.0
Greenhill	60	−5	25.8	2.38	10.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Greenville	61	— 8	26.2	2.39	9.5
Hanging Rock	73	5	34.0	2.71	1.5
Hedges				1.15	5.6
Hillhouse	56	—10	24.0	1.86	11.5
Hiram	57	—10	24.2	2.22	9.5
Hudson	56	—12	23.5		
Jacksonboro	59	— 8	26.2	3.22	19.0
Killbuck	59	— 6	26.0	1.38	7.9
Lancaster	65	— 2	29.6	4.25	8.5
Lima	50	— 8	24.4	2.78	16.0
McConnelsville	67	— 1	30.3	2.59	9.5
McCormick				2.99	
Manara	62	— 4	27.4	2.76	6.0
Mansfield				2.41	14.4
Marietta	69	6	32.4	3.17	3.5
Marion	60	— 8	26.4	3.11	
Medina	58	—10	25.0	2.31	14.0
Milfordton				3.54	
Milligan	71	—13	28.6	3.88	8.0
Millport	59	— 7	25.6	2.85	9.8
Montpelier	53	—10	22.8	1.91	15.5
New Alexandria	61	— 2	28.6		
New Berlin	58	— 8	25.6	2.32	6.5
New Bremen	60	— 8	26.4	1.76	12.4
New Lexington				2.76	
New Richmond	72	— 1	31.5	2.02	0.4
New Waterford	54	— 6	26.0	2.61	10.0
North Lewisburg	57	— 9	26.2	2.60	11.0
North Royalton	56	— 8	25.2	2.48	17.5
Norwalk	59	— 7	25.6	3.02	17.0
Oberlin	59	— 6	26.4	1.89	12.2
Ohio State University	61	— 4	27.2	2.46	11.0
Orangeville	57	— 5	25.2	1.93	10.0
Ottawa	58	— 8	25.7	2.23	18.0
Pataskala	62	— 4	27.0	3.05	10.7
Philo	65	— 1	29.6	3.32	4.9
Plattsburg	60	— 7	26.1	2.77	17.0
Pomeroy	68	4	32.5	1.64	4.0
Portsmouth *a*				2.98	4.0
Portsmouth *b*	73	7	33.6	1.97	
Pulse				3.01	11.5
Redlion				1.91	
Richfield				3.20	10.5
Richwood	60	— 8	26.4	1.92	10.0
Ripley	67	— 1	30.2	2.34	6.1
Rittman	59	— 7	26.7	2.49	9.7
Rockyridge	59	—10	25.2	1.39	8.6
Shenandoah	58	— 9	25.6	1.81	11.1
Sidney	59	— 7	26.6	2.51	13.2
Somerset	65	— 2	31.1		
Springfield				2.10	8.4
Strongsville				1.47	9.5
Swanton				0.94	4.0
Thurman	72	3	32.7	2.74	5.0
Tiffin	59	— 6	26.1	2.44	16.0
Upper Sandusky	60	— 7	26.8	2.40	18.0
Urbana	57	—10	23.5	2.31	
Vanwert	60	1	25.8		
Vickery	59	— 6	25.0	1.52	7.9
Wadsworth				2.35	
Walnut				2.63	6.6
Warren	58	— 5	26.7	2.84	14.7
Warsaw	61	3	27.4	2.75	10.0
Wauseon	59	— 9	23.8	1.24	11.3
Waverly	69	— 1	31.0	2.75	5.7
Waynesville	62	0	26.4	1.85	
Wellington	60	— 6	26.2	2.22	15.0
Williamstown				1.23	
Willoughby				3.08	3.0
Wooster	60	— 8	24.4	3.54	18.5
Zanesville				3.44	11.4
Oklahoma.					
Arapaho	72	7	35.6	0.06	0.2
Blackburn	69	6	39.2	0.59	T.
Burnett	74	10	40.1	0.55	
Chandler	68	11	40.4	0.38	
Cleo	71	15	40.0	T.	
Clifton	75	7	38.8	0.39	
Cloud Chief	78	9	38.8	0.40	
Enid	70	11	36.4	T.	T.
Fort Reno	70	12	37.9	0.73	
Fort Sill	73	16	40.4	0.35	
Guthrie	70	13	38.2	0.54	
Hennessey	72	11	36.7	T.	
Jefferson	71	9	35.4	0.06	
Jenkins	76	9	37.6	0.10	T.
Kenton	71	9	35.9	0.15	1.5
Kingfisher	72	13	38.8	0.25	T.
Mangum	71	17	38.8	0.30	
Newkirk	62[4]	13[4]	37.4[4]	0.12	T.
Norman	76	13	41.2	0.56	
Pawhuska	65	5	36.4	0.32	0.2
Perry	68	11	38.4	0.29	
Sac and Fox Agency	69	11	38.1	0.42	T.
Shawnee	73	14	41.1	0.62	
Stillwater	70	12	39.0	0.25	
Taloga	75	16	39.2	T.	T.
Temple	76	15	42.4	0.47	
Oklahoma—Cont'd.					
Ural	81	7	36.1	0.52	T.
Watonga	77	14	39.8	0.01	
Weatherford	77	12	38.1	0.17	T.
Waukomis	72	13	39.1	0.30	
Oregon.					
Albany *b*				6.94	0.5
Alpha	56	25	42.1	20.17	8.4
Arlington	60	17	36.4	1.00	
Ashland	61	29	38.2	5.96	9.4
Aurora (near)	56	25	41.2	6.32	1.2
Bay City	60	29	44.4	27.03	5.5
Bend	57	8	32.6	3.46	
Beulah	52	5	23.8	2.36	17.0
Blackbutte	52	24	37.4	11.10	22.0
Blalock	61	21	38.0	1.23	T.
Bullrun				11.92	2.5
Cascade Locks	56	29	39.2	17.28	27.0
Coquille				13.85	
Corvallis	56	25	40.6	7.24	3.0
Dayville	58	16	36.4	0.76	3.2
Doraville	53	26	39.2	9.52	26.0
Drain	57	28	42.4	14.31	3.0
Ella				0.88	3.0
Eugene	57	25	40.6	8.93	11.0
Fairview	60	27	45.6	15.82	3.0
Falls City	55	25	40.3	16.30	17.9
Forestgrove	58	22	40.6	9.59	2.5
Gardiner	64	32	48.1	19.73	
Glenora	54	24	39.9	28.39	32.5
Government Camp	58	8	31.4	11.61	40.0
Grants Pass	58	26	39.6	11.69	9.8
Grass Valley	55	7	33.4	1.95	1.5
Heppner	66	18	37.8	1.18	3.0
Hood River (near)	52	22	35.8	8.94	29.6
Huntington	45	— 2	28.4	2.22	23.0
Jacksonville	57	19	38.0	10.83	8.8
Joseph	50	3	25.8	1.92	11.0
Kerby	58	22	39.4	23.06	25.0
Klamath Falls	55	9	31.6	3.90	7.0
Lagrande	54	9	32.3	2.72	4.5
Lakeview	52[d]	0	29.3	3.59	23.3
Lonerock	62	15	34.2	1.59	5.0
McKenzie Bridge	57	19	37.7	15.00	
McMinnville	55	25	41.9	9.39	2.0
Monroe	57	22	41.4	11.84	16.0
Mount Angel	56	27	41.5	5.97	1.8
Nehalem				23.03	8.4
Newberg	55[e]	27[e]	42.1[e]	7.02	T.
Newport	57	33	46.2	10.79	
Pendleton	62	22	38.2	1.08	4.2
Pine [d]	60	— 8	27.3	2.20	16.0
Placer				8.07	
Prineville	59	11	34.6		
Riverside	58	— 5	29.4	2.44	9.5
Salem *b*	57	29	43.2	4.56	
Silverlake	62	— 3	31.8	1.73	10.0
Sparta	50	8	26.5	3.20	27.0
Stafford	55[f]	25[f]	39.6[f]	9.74	T.
The Dalles	58	16	37.4	2.87	4.0
Toledo	63	30	45.8	13.08	T.
Umatilla	61	18	37.6	0.33	T.
Vale	55	— 2	27.0	1.43	10.0
Wamic	61	8	35.1	4.66	6.0
Warm Spring	63	8	36.6	2.37	5.0
Weston	63	17	33.6	1.14	3.6
Williams	60	20	39.7	14.49	20.5
Pennsylvania.					
Aleppo	66	— 4	30.8	2.89	
Altoona	52	— 3	25.2	3.84	
Athens	48	— 1	25.3	2.60	10.4
Beaver Dam				2.95	8.0
Bellefonte	46	2	27.3	2.78	16.0
Brookville				3.46	14.8
Browers				3.70	
Butler	55	— 3	26.3	2.55	10.0
California	68	5	33.4	2.40	5.7
Cassandra	49	— 3	24.8	2.89	21.0
Centerhall	45	0	25.0		
Clarion				4.31	23.7
Coatesville	52	7	30.0	4.60	5.5
Confluence				4.82	12.0
Davis Island Dam				2.70	7.0
Derry Station	61	0	28.9	2.81	10.0
Doylestown				4.45	
Driftwood				2.03	
Dushore	45	— 5	23.7	2.61	10.2
Dyberry	44	—13	21.8	3.62	12.8
East Bloomsburg				2.68	13.5
East Mauch Chunk	50	3	26.8	4.21	10.0
Easton	47	5	27.6	4.13	5.5
Ellwood Junction				1.50	5.5
Emporium	46	— 4	24.5	4.07	22.7
Ephrata	50	4	28.0	4.43	6.8
Everett	49[f]	— 4[f]	25.5[f]	3.41	10.0
Forks of Neshaminy				3.84	
Franklin	55	— 7	25.6	2.00	18.0
Freeport				3.37	10.2
Girardville				4.28	19.0
Pennsylvania—Cont'd.					
Greensboro				1.52	6.0
Greenville	52	— 6	25.8	2.75	15.8
Hamburg	47	5	27.9	3.73	6.0
Hamlinton	52[d]	0	23.5	1.75	10.5
Herrs Island Dam				2.62	6.0
Huntingdon *a*				4.10	14.0
Huntingdon *b*	45	2	27.5	3.80	14.5
Irwin	65	0	30.8	2.15	8.0
Johnstown	55	— 1	28.9	4.53	17.6
Kennett Square [f]	49	8	29.2	4.07	5.5
Lansdale				2.37	
Lawrenceville	49	— 5	23.8	2.62	13.5
Lebanon	49	5	28.8	4.68	12.6
Leroy	44	— 3	23.2	2.95	11.2
Lewisburg	45	— 6	25.6	3.95	14.5
Lockhaven *a*	44	— 1	26.2	3.73	10.0
Lockhaven *b*				3.78	15.4
Lock No. 4				2.77	8.9
Lycippus	60	0	28.6	3.48	15.6
Mifflin				3.54	17.0
Milford	51	— 5	25.4	1.82	8.8
Oil City				3.82	21.0
Ottsville				3.05	
Parker				3.38	12.4
Philadelphia	52	11	33.1	4.28	5.0
Pocono Lake	44	— 5	22.5	1.83	
Point Pleasant				4.11	
Pottsville				4.04	
Quakertown	49	6	28.2	4.35	8.0
Reading [3]			28.2	4.60	
Renovo *a*	45	1	26.2	3.02	23.5
Renovo *b*				2.78	15.0
Saegerstown	51	— 5	24.8	2.88	16.9
St. Marys	44	— 4	21.6	2.87	22.5
Saltsburg				3.00	12.5
Seisholtzville				5.09	
Selinsgrove	44	— 1	26.6	4.20	15.0
Shawmont				3.99	
Smethport	46	— 6	22.2	4.20	21.0
Smiths Corners				4.02	
Somerset	54	— 6	25.3	4.13	18.6
South Bethlehem	49	5	28.0	5.03	12.8
South Eaton	49	1	26.2	2.78	8.0
Spring Mount				4.29	
State College	47	— 1	24.9	3.50	10.8
Towanda	49	2	25.6	2.62	9.0
Troutrun				1.59	11.5
Uniontown	67	7	33.5	1.68	3.5
Warren	52	— 3	24.4	2.55	19.0
Wellsboro	52	3	26.3	1.86	13.5
Westchester	49	7	30.3	4.91	6.0
West Newton				3.52	10.0
Wilkesbarre	49	6	28.0	2.09	5.5
Williamsport	44	2	26.8	3.95	11.5
York	51	4	30.4	4.67	11.2
Rhode Island.					
Bristol	48	3	31.6	4.75	6.0
Kingston	52	— 2	27.6	5.50	7.0
Pawtucket	47	6	29.4	4.86	0.1
Providence *a*	51	3	30.3	4.98	7.5
Providence *c*	50	— 2	28.3	4.82	6.0
South Carolina.					
Aiken	72	18	45.9	3.10	
Allendale	67	23	45.2	5.99	
Anderson	66	16	41.8	4.20	
Barksdale	65[d]	15[d]	40.8[d]	3.55	
Batesburg	69	17	42.9	4.78	
Beaufort	74	27	49.4	4.82	
Bennettsville	70	19	44.2	2.66	
Blackville	74	21	44.4	3.07	
Bowman	73	20	45.8	5.03	
Calhoun Falls				2.53	
Camden				2.84	
Cheraw *a*	71	18	42.0	2.53	
Cheraw *b*				2.55	
Clarks Hill	71	18	44.0	3.15	
Clemson College	77	14	39.4	5.21	
Conway	75	21	46.4	4.24	
Darlington	73	18	43.6	3.95	
Duewest	66	18	43.4	3.22	
Edisto				3.86	
Effingham				5.50	
Florence	71	23	44.4	4.24	
Gaffney	68	17	39.2	4.96	
Georgetown	75	25	46.0	7.10	
Gillisonville	75	23	47.4	3.58	T.
Greenville	64	14	37.5	4.94	
Greenwood	66	18	39.8	3.94	
Heath Springs	60	15	39.2	4.00	
Kingstree *b*				3.02	
Liberty	65	13	40.7	5.10	
Little Mountain	69	17	42.7	3.29	T.
Longshore	67	16	41.8	3.11	T.
Pinopolis *1	75	26	49.1	4.39	
St. Stephens				3.91	
Saluda	70	17	43.1	2.58	
Santuck	68	15	40.4	3.46	T.
Seivern	75	21	45.1	4.01	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Smiths Mills				3.55	
Society Hill	69	19	43.2	2.59	
Spartanburg	65	16	38.8	5.04	T.
Statesburg	71	20	45.1	2.86	T.
Summerville	75	23	46.6	4.90	
Temperance	70	24	42.9	3.98	
Trenton	69	19	44.0	3.09	
Trial	75	16	46.2	5.92	
Walhalla	65	18	39.6	2.40	
Winnsboro	65	18	38.6	3.49	T.
Winthrop College	67	16	40.8	3.35	T.
Yorkville	68	19	41.8	3.00	
South Dakota.					
Aberdeen	38	−18	11.0	0.40	4.0
Academy	47	−11	20.4	0.08	0.8
Alexandria	42	−15	14.5	T.	T.
Armour	46	−13	16.6	0.10	1.0
Ashcroft	55	−13	24.2	0.53	5.3
Bowdle	49	−20	13.6	0.20	2.0
Brookings	40	−17	13.8	0.10	1.0
Canton	47	−10	21.0	T.	T.
Centerville				0.27	2.8
Chamberlain	46	−12	19.8	0.04	0.8
Cherry Creek	52	−21	20.6	0.05	0.5
Clark	44			0.30	3.0
Doland	40	−22	13.6	0.37	3.7
Elkpoint	47	− 8	22.4	0.27	0.8
Fairfax	46[j]	−12[j]	20.4[j]		
Farmingdale				0.12	0.5
Faulkton	44	−16	13.2	0.11	2.0
Flandreau	42	−15	15.6	0.13	1.5
Forestburg	42	−21	12.4	0.35	3.5
Fort Meade	60	− 3	29.4	0.50	0.5
Gannvalley	42	−16	16.3	0.50	5.0
Gettysburg	40	−12	10.6	0.17	
Grand River School	54	−21	19.6	0.28	7.0
Greenwood	48	− 9	23.3	0.17	1.7
Highmore				0.05	0.5
Hotch City	42	−18	17.4	T.	T.
Howell	43	−17	14.0	0.06	0.5
Ipswich	44	−19	13.0	0.08	1.0
Kimball	45	−16	17.6	0.36	3.6
Leola	40	−23	8.2	0.20	2.0
Marion	43	−14	18.4		
Mellette	44	−22	12.5	0.22	0.4
Menno	44	−15	18.5	0.18	2.0
Millbank	45	−16	12.4	0.55	
Mitchell	44	−15	15.9	0.40	4.0
Oelrichs	51	− 9	26.2	0.60	5.0
Pedro	53	−12	22.2	T.	T.
Pine Ridge	47	−24	22.4	0.42	3.5
Plankinton	51[j]	−16	18.8[j]	0.15	1.5
Ramsey	42	−18	15.6	T.	T.
Redfield	55	−21	12.2	0.04	1.2
Rosebud	48	−12	24.2	0.20	2.7
Silver City				0.25	1.7
Sioux Falls	41	−14	17.0	0.20	
Sisseton Agency	42	−20	13.0	0.69	6.0
Spearfish	62	− 1	31.4	0.52	3.2
Tyndall	43	−12	18.8	0.18	
Vermilion	57	− 9	21.4	T.	T.
Watertown	41	−20	12.1	0.15	1.5
Waubay	40	−23	10.8	0.28	
Wentworth	38	−18	14.8	0.67	5.3
Wolsey				0.15	1.5
Tennessee.					
Andersonville	66	8	36.2	2.40	T.
Ashwood	77	13	40.2	3.22	T.
Benton	73	10	39.4	2.93	T.
Bluff City				1.55	0.5
Bolivar	72	14	38.2	3.20	T.
Bristol	65	9	33.6	2.86	T.
Byrdstown	72	9	37.7	2.95	1.0
Carthage	72	12	39.4	2.71	0.8
Charleston				3.03	0.2
Clarksville	71	13	38.2	2.56	2.5
Clinton				3.60	2.0
Covington	71	15	39.6	4.27	T.
Decatur	71	10	37.7	3.83	0.5
Dover	70[e]	10[e]	38.3[e]	2.17	
Elizabethton	70	8	36.3	1.71	0.5
Erasmus	71	1	34.6	3.32	2.2
Florence	72	14	39.1	3.69	0.5
Franklin	72	14	38.6	2.53	0.8
Grace[*1]	74	14	38.4	3.10	2.0
Greeneville	72	3	36.0	1.87	2.5
Halls Hill				2.85	
Hohenwald	74	6	37.8	3.91	1.1
Iron City	74	9	39.4	5.52	
Isabella	68	12	36.6	3.47	2.5
Jackson	75	12	40.8	3.45	
Johnsonville	72	10	39.2	2.49	0.5
Jonesboro	69	9	37.4	1.59	1.3
Kenton[**]	72	15	39.0	2.69	1.2
Kingston				2.92	
Leadvale				1.20	1.0
Lebanon	72	12	37.6		
Lewisburg	74	13	39.6	3.96	1.5
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Liberty				2.99	T.
Lynnville	73	15	39.4	4.20	T.
McKenzie	70[c]	14[c]	40.9[c]	2.64	
McMinnville	75	10	38.4	2.73	1.8
Maryville	71	11	38.0	2.40	1.0
Newport	72	12	38.0	1.71	4.0
Nunnelly	73	8	38.5	2.36	
Oakhill	67	8	36.2	1.77	
Palmetto	73	14	39.8	3.75	T.
Pope	75	9	39.5	3.18	T.
Rogersville	72	8	37.6	2.21	0.5
Rugby	71	2	34.6	4.53	10.0
Savannah	75	13	41.4	3.33	T.
Sewanee	69	9	36.5	2.20	2.0
Silverlake	64	7	33.2	3.09	10.8
Springdale	71	8	37.4	2.57	2.0
Springville	74	7	41.6	2.09	1.8
Tazewell				2.23	1.0
Tellico Plains	73	11	40.5	2.50	T.
Tracy City	70	8	36.6	2.84	4.0
Trenton	72	13	40.4	3.16	T.
Tullahoma	74	12	39.2	3.63	0.4
Union City	71[j]	14[j]	38.6[j]	3.48	1.5
Waynesboro	73	10	39.2	3.37	2.0
Wildersville	71	13	41.0	2.59	1.5
Yukon	74[g]	13[g]	40.3[g]	3.28	
Texas.					
Albany	74	20	44.8	2.12	
Alvin				3.94	
Arthur				1.42	
Austin *a*	80	25	51.1	1.50	
Austin *b*[**]	76	22	45.9		
Ballinger	78	19	44.6	2.14	
Beaumont	82	32	52.1	4.51	T.
Beeville	81	31	53.3	1.41	
Bigspring	77	17	44.2	0.81	1.8
Blanco	72	24	45.8	3.26	
Boerne[*1]	77	20	47.2	3.35	
Bonham[1]	77	19	45.4	0.58	
Booth				3.87	
Bowie	80	16	43.4	1.56	
Brazoria	79	33	54.6	4.55	
Brenham	80	26	49.8	4.84	
Brighton	78	31	55.6	1.12	
Brownwood				2.00	
Burnet	85	19	45.9	3.05	
Camp Eagle Pass	83	27	51.8	2.80	
Childress	82	19	42.2	0.60	4.5
Coleman	84	20	48.4	1.73	
College Station	82	24	50.2	2.71	
Colorado	78	14	42.8	1.14	1.8
Columbia	77	32	53.8	3.26	
Comanche	81[d]	15[d]	46.2[d]	2.30	
Corsicana	82	25	50.0	2.70	
Cotulla	78	30	53.4	2.27	
Cuero	80	28	51.0	4.07	
Dallas	78	18	43.8	2.15	
Danevang	79	28	52.8	2.55	
Dublin	79	19	43.1	1.10	
Duval	83	23	49.3	1.58	
Estelle	81	18	44.6	2.04	
Fort Brown	87	37	59.6	2.35	
Fort Clark	77	22	46.6	2.60	
Fort Davis	77	17	43.4	1.38	5.0
Fort McIntosh	87	31	55.0	3.42	
Fort Ringgold	91	32	59.1	2.80	
Fort Stockton				2.18	1.0
Fredericksburg	79[e]	22[e]	47.4[e]	3.06	
Gainesville	82	15	42.4	1.62	
Gatesville	83	19	47.7	2.33	
Georgetown	84	23	50.2	1.58	
Grapevine	82	21	44.8	2.39	
Greenville	77	17	42.9	1.62	
Hale Center	76	16	43.5	0.12	1.2
Hallettsville	82	29	53.1	3.34	
Haskell	77	19	43.4	1.15	2.0
Hearne	84	22	50.8	3.55	
Henrietta	79	19	42.5	1.83	
Hewitt				2.35	T.
Hondo				3.23	
Houston	80	30	50.9	4.39	
Huntsville	70	26	48.2	5.00	
Ira	78	16	44.4	0.99	4.0
Jacksonville	82	22	48.8	3.55	
Jasper	85	28	52.8	3.68	
Kaufman	75	22	46.3	1.86	
Kent				1.15	5.2
Kerrville	80	20	47.5	2.53	
Kopperl				2.69	
Lampasas	86	19	46.4	2.52	
Lapara				1.55	
Laureles Ranch				1.59	
Llano	80	25	47.6	2.25	
Longview	80	23	45.6	1.12	
Luling	82	25	48.7	2.06	
Mann	81	18	48.0	3.07	
Marlin	81	22	45.6	1.72	
Menardville	85	15	44.2	2.88	
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mount Blanco	77	16	41.6	0.60	6.0
Nacogdoches	81	23	46.7	4.86	
New Braunfels[c]	76	28	50.1	2.73	
Panter				2.75	
Paris *a*	78	12	42.8	0.50	
Pearsall	80	29	51.8	2.80	
Rhineland	78	16	44.4	1.15	
Rockisland	81	27	52.0	3.44	
Rockport	68	40	54.2	1.15	
Runge	84	29	52.4	1.99	
Sanderson	68	24	47.1	1.70	
San Marcos	79	26	50.2	3.63	
San Saba	84	18	47.4	2.33	
Santa Gertrude Ranch				0.87	
Shaeffer Ranch	86	30	54.5	1.43	
Sherman	68	21	44.1	1.14	
Sonora	85	20	46.4	2.61	
Sugarland	80	31	53.1	1.65	
Sulphur Springs	76	21	45.4	1.93	
Temple *a*	80	21	44.8	2.02	
Temple *b*	81	19	45.8	1.77	
Trinity	80	25	51.2	5.49	
Tyler	80	22	45.3	2.39	
Victoria	84[d]	30[d]	54.1[d]	1.45	
Waco	85	30	51.7	2.55	
Weatherford	80	16	44.5	2.29	
Weimar	84	27	52.6	5.00	
Wharton	76	29	53.6	4.60	
Wichita Falls				1.35	
Utah.					
Aneth	53	− 4	26.4	0.11	0.2
Blackrock	55	−13	29.6	1.11	8.0
Bluecreek[*1]	50	8	31.7	1.90	6.5
Callao	54[c]	− 2[c]	29.2[c]	0.50	
Castledale	49	− 6	21.4	0.08	0.8
Cisco	56	2	22.6	0.00	
Corinne	49	4	28.0	3.62	13.3
Coyoto	49[d]	− 8[d]	19.8[d]	0.01	0.1
Deseret	59	− 8	29.0	0.94	1.0
Emery	46	2	26.2	T.	
Escalante	51	− 4	23.0	1.50	15.0
Farmington	52	12	29.8	3.76	25.0
Fillmore	60	− 2	33.5	1.44	
Frisco	62	5	32.3	0.75	
Giles	51	−10	18.8	0.10	
Government Creek	48	− 1	29.2	1.43	12.7
Green River	45	−12	20.2	0.00	
Grover	55	5	29.2	T.	T.
Heber	44	− 6	24.2	2.17	13.2
Henefer	50	−12	25.3	2.91	27.5
Hite	60	13	34.4	0.30	
Huntsville				7.72	34.0
Ibapah	65	−15	29.2	0.25	2.5
Kelton	42	− 2	22.8	0.60	6.0
La Sal	47	4	25.0	0.60	6.0
Levan	45	0	26.0	1.64	11.8
Loa	43	−19	15.2	0.60	6.0
Logan	47	6	27.2	2.62	
Lund[d]	53	5	31.2	0.25	2.0
Manti	50	* 5	27.8	0.73	T.
Marysvale	52	1	28.9	0.40	1.5
Meadowville	46	− 5	23.0	4.10	28.0
Millville				2.97	
Minersville	65[c]	7	33.3	0.14	T.
Moab	59	3	27.0	0.12	T.
Monticello	44	1	26.2	T.	T.
Morgan				4.60	22.1
Mount Nebo	58	5	28.1	1.37	7.0
Mount Pleasant	50	0	27.2	1.24	11.0
Ogden *a*	50	9	28.7	4.77	16.1
Park City	49	1	27.1	3.88	38.8
Parowan	57	7	30.9	1.10	10.0
Pinto	61[d]	3[d]	30.0[d]	0.93	
Plateau	50	− 9	24.0	1.09	12.5
Provo	58	− 1	29.9	2.65	8.9
Ranch	48	1	25.2	1.03	
Richfield	57	3	30.3	0.60	
St. George	66	13	38.7	0.27	
Scipio	57	−10	29.6	1.51	
Snowville	48	− 9	24.6	1.93	
Terrace	48	3	26.4	0.85	3.5
Thistle	50	2	21.8		
Tooele	54	8	30.7	1.46	
Tropic	51	− 6	23.2	T.	T.
Vernal	48	− 9	18.6	0.39	0.8
Wellington	50[f]	− 4[f]	23.8[f]	0.52	3.0
Woodruff	49	−21	14.8	1.50	15.0
Vermont.					
Bellows Falls				2.63	11.5
Burlington	43	−13	21.9	2.18	13.5
Chelsea	42	−23	15.4	2.30	20.0
Cornwall	43	−17	20.4	2.28	10.0
Enosburg Falls	45	−27	15.4	2.88	21.0
Hartland	57	−36	19.0	3.63	
Jacksonville	42	−20	19.4	2.14	10.7
Manchester	45	−13	21.8	2.59	10.8
Morrisville	42	−25	17.2	5.26	24.0
Norwich	42	−25	17.0	4.13	18.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Vermont—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Johnsbury	40	−27	16.0	3.24	18.0
Wells	44	−18	18.6	2.70	7.0
Wells River				3.07	11.0
White River Junction				3.08	11.2
Woodstock	55	−21	20.2	3.11	16.0
Virginia.					
Alexandria	56	11	33.7	4.18	1.7
Ashland	63	13	35.4	4.50	0.5
Barboursville	65	12	36.5	5.04	1.2
Bedford	65	12	36.2	5.14	0.5
Big Stone	68	4	35.8	2.42	1.5
Blacksburg	63	6	32.5	3.96	1.8
Bonair	63	8	36.1	4.01	0.5
Buckingham	66	10	36.4	4.66	2.0
Burkes Garden	59	1	29.7	3.20	7.0
Callaville	63	16	37.3	2.90	.....
Charlottesville	65	12	35.7	5.12	1.7
Clarksville				2.84	.....
Columbia	64	8	33.0	3.60	2.0
Dale Enterprise	64	5	31.6	4.26	10.0
Danville				3.71	T.
Farmville	67	15	38.2	4.50	T.
Fredericksburg[e]	54	14	33.2	2.97	1.0
Grahams Forge	61[e]	8[e]	32.6[e]	3.93	6.0
Hampton	61	18	40.6	3.48	T.
Hot Springs	61	5	30.0	4.70	9.0
La Crosse	65	11	37.8	3.50	T.
Lexington	62	10	33.8	4.70	5.3
Lincoln	50	9	31.5	3.73	3.0
Mendota				2.51	1.0
Newport News	62	11	40.2	3.65	
Petersburg	58	16	36.9	2.72	T.
Radford				2.86	4.0
Riverton				4.00	2.0
Roanoke	56	7	33.0	4.20	6.4
Rockymount	61	12	33.4	4.96	2.8
Saxe	63	11	37.7	4.01	T.
Shenandoah				4.50	5.0
Speers Ferry				2.72	1.0
Spottsville	64	15	39.2	3.09	T.
Stanardsville	62	0	28.2	2.55	5.0
Staunton	64	11	34.6	4.06	7.0
Warsaw	58	11	35.4	2.65	1.0
Westpoint	61	10	34.4	2.80	T.
Wilkerson	60	14	35.5	3.03	2.3
Williamsburg	62	13	39.0	2.47	T.
Woodstock	60	5	29.6	2.95	4.5
Wytheville	64	8	31.9	3.43	7.5
Washington.					
Anacortes				3.20	
Ashford				12.12	12.5
Blaine	56	26	39.1	5.64	2.2
Bremerton	59	28	40.8	5.70	9.0
Brinnon	55	29	40.8	8.32	6.0
Cedonia	42	9	26.6	1.99	12.7
Centralia	57	28	41.6	10.38	2.2
Cheney				2.36	15.0
Clearwater	58	28	41.6	18.50	13.7
Cle Elum	46	8	29.0	7.36	28.0
Colfax	51	6	33.5	4.30	7.0
Colville	44	5	27.8	2.60	16.5
Connell				1.00	2.5
Conconully	44	4	24.8	1.44	13.6
Coupeville	55	30	41.4	1.64	0.5
Crescent	42	8	28.4	2.43	8.5
East Sound				4.60[f]	T.
Ellensburg	45	12	27.7	0.67	.....
Grandmound	57	26	41.6	10.20	1.6
Granite Falls				3.59	
Hooper	56	11	34.8	1.44	2.0
Ilwaco	57	31	43.6	17.22	3.0
Lacenter	55	23	39.8	7.44	2.8
Lakeside	49	8	27.0	1.81	12.5
Lind	51	20	32.9	1.79	6.0
Loomis	42	13	27.7	0.70	5.0
Mayfield [1]	55	25	39.4	10.09	
Mottinger Ranch	60	19	37.2	0.57	T.
Mount Pleasant	54	30	38.9	7.60	4.0
Moxee	51	8	29.6	0.51	1.0
Olga	59	32	42.8	4.60	0.5
Olympia	57	29	42.4	11.27	T.
Pinehill	56	16	35.8	4.52	14.8
Pomeroy	58	18	36.4	2.60	5.0
Port Townsend	55	34	42.2	1.66	T.
Pullman	49	14	31.8	3.71	4.0
Rattlesnake Mountains	53	16	31.3	0.83	4.0
Republic	44	2	25.0	1.55	13.7
Ritzville				0.75	6.5
Ritzville (near)				0.75	.....
Rosalia	49	9	31.4	2.97	6.5
Sedro	55	27	40.0	6.47	5.0
Silvana	56	28	40.8	3.34	
Snohomish	56	25	39.8	3.30	2.5
Snoqualmie	54	25	39.4	17.85	T.
Southbend	55	30	43.6	18.83	9.5
South Ellensburg	46	14	28.9	0.37	3.0
Sprague				1.40	6.0
Sunnyside	59	21	34.4	0.17	.....

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Trinidad	46	12	28.8	0.54	5.0
Union	56[f]	30[f]	40.8[f]	15.22	10.4
Usk	43	8	28.8	4.34	16.5
Vancouver	56	25	41.6	5.29	T.
Vashon	55	30	42.1	6.46	
Waterville	45	4	23.4	2.10	18.5
Wenatchee (near)	49	10	27.8	1.87	12.0
Whatcom	57	25	41.5	4.11	1.0
Wilbur	41	4	25.8	1.91	6.0
Zindel	55	22	37.4	1.08	
West Virginia.					
Addison	70	5	33.2	3.00	6.0
Bayard	60	−3	24.8	4.38	6.5
Beverly	64	3	29.7	4.69	15.0
Bluefield	65	8	34.6	5.30	20.0
Buckhannon	68	0	31.6	3.41	8.0
Burlington	50	−2	28.2	3.35	11.0
Byrne	75	5	32.8	4.50	8.0
Camden	68	−4	33.2	2.45	13.6
Central [b]	72	1	23.6	2.09	7.3
Charleston				2.45	3.5
Clay	76	3	32.5	2.95	7.5
Creston	60	1	32.1	2.55	7.0
Cuba	75	−2	34.6	2.48	3.2
Dayton	70	−2	32.0	2.51	5.5
Echo	79	5	34.6	2.92	3.5
Elkhorn	67	7	35.6	2.40	8.0
Fairmont				2.76	6.0
Glenville	74	−5	31.4	3.64	10.0
Grafton	70	3	32.6	2.57	5.8
Green Sulphur	56	5	31.1	2.81	6.0
Harpers Ferry				3.41	9.5
Hinton *b*	64	8	33.6	3.49	7.7
Huntington	72	8	33.2	2.46	0.8
Josiah	69	4	31.6	3.86	14.0
Lewisburg	62	5	29.9	3.74	10.5
Lillydale	66	7	33.2	2.96	4.9
Logan	75	8	37.8	3.74	5.0
Magnolia	50	−2	27.8	3.19	12.0
Martinsburg	54	5	29.2	2.95	5.0
Morgantown	68	1	31.7	2.87	8.0
Moscow	60	−2	28.4	2.00	7.0
Moundsville	66	0	31.5	2.34	9.0
New Martinsville	69	2	32.6	3.00	9.5
Nuttallburg	70	5	36.1	2.90	16.0
Oldfields	55	0	31.1	2.58	8.0
Parsons	65	4	31.5	2.80	14.0
Philippi	71	−2	32.4	4.72	7.0
Pickens	66	1	30.4	6.45	29.0
Point Pleasant	73	7	31.8	2.65	2.0
Powellton	74	8	35.6	1.79	9.4
Princeton	62	7	32.4	4.25	12.5
Romney	52	1	29.8	3.08	6.0
Rowlesburg				4.34	16.0
Ryan	75	−3	33.4	2.78	3.0
Southside	74	10	35.7	2.96	2.5
Terra Alta	62	−3	25.8	5.60	24.0
Travellers Repose	54	−7	25.4	4.53	23.0
Uppertract	64	6	31.4	2.62	6.0
Wellsburg	61	−1	28.0	2.94	9.0
Weston *a*				3.01	7.6
Wheeling *a*				1.86	7.0
Wheeling *b*	66	4	33.5	2.14	4.0
Williamson	75	8	34.2	2.74	2.0
Wisconsin.					
Amherst	37	−10	13.0	0.35	3.5
Antigo	38[e]	−16[d]	11.8[d]	0.30	3.0
Appleton	39	−12	15.6	1.29	8.8
Ashland				0.41	3.5
Barron	46	−22	11.8	0.59	5.9
Beloit	43	−6	21.2	0.57	3.5
Brodhead	55	−9	21.6	0.20	2.0
Butternut	40	−24	10.2	0.75	7.5
Chilton	41	−12	15.6	1.18	10.0
Citypoint	40	−20	16.7	0.05	5.0
Darlington	39	−10	17.6	0.62	1.2
Dodgeville	45	−12	19.4	0.60	6.0
Downing	40	−22	12.2	0.30	3.0
Easton	41	−19	15.0	0.47	6.7
Eau Claire	38	−15	14.0	0.32	3.2
Florence	41	−20	13.6	T.	T.
Fond du Lac	42	−10	19.8	0.50	5.0
Grand River Locks				0.51	6.0
Grantsburg	36	−29	11.8	0.82	8.2
Hancock	38	−17	13.6	0.23	2.3
Harvey	43	−8	19.6	0.36	4.3
Hayward	37	−23	10.7	0.38	4.2
Hillsboro	45	−19	15.6	0.40	4.0
Koepenick	42	−23	13.4	0.62	6.2
Ladysmith	36	−18	13.1	0.38	3.5
Lancaster	43[e]	−10[d]	20.6[d]	0.18	2.2
Madison	40	−9	18.6	0.10	1.0
Manitowoc	43	−10	19.2	0.70	9.2
Meadow Valley	41	−14	14.0	0.38	5.0
Medford	44	−15	14.8	0.20	2.0
Menasha				0.38	5.5
Neillsville	38	−20	12.7	0.10	1.0
New Holstein	42	−12	15.6	1.60	9.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
New London	40	−14	14.4	0.61	5.0
North Crandon	35	−21	11.2	.....	
Oconto	41	−13	17.1	1.23	13.0
Osceola	38	−24	9.2	0.67	7.0
Oshkosh	41	−11	19.8	0.39	2.0
Pine River	42	−14	15.7	0.36	8.7
Portage	43	−10	19.0	0.15	1.0
Port Washington	44	−10	20.2	0.95	8.0
Prairie du Chien *a*	53	−7	23.7	0.22	2.5
Prairie du Chien *b*				0.36	4.5
Prentice	41	−21	11.6	0.45	4.5
Racine	45	−8	23.0	0.57	.....
Sheboygan	41	−9	21.9	1.43	13.0
Spooner	36	−22	10.5	0.62	6.7
Stevens Point	39	−19	13.8	0.40	3.5
Tomahawk	42	−28	9.2	1.20	12.0
Valley Junction	43	−11	17.0	0.04	1.0
Viroqua	40	−12	16.4	0.38	3.6
Watertown	42	−11	18.4	0.79	8.0
Waukesha	41	−9	20.2	0.48	4.7
Waupaca	38	−15	14.3	0.41	7.6
Wausau	37	−12	13.7	0.47	.....
Whitehall	50	−21	16.4	0.22	2.2
Wyoming.					
Alcova	52	0	28.2	0.92	8.5
Basin	53	−7	22.2	T.	T.
Bedford	40	−16	16.8	2.63	19.1
Border	41	−27	8.9	2.34	.....
Buffalo	58	−4	26.1	0.35	6.6
Centennial	42	−10	24.6	1.38	.....
Chugwater	54	1	30.2	0.50	4.5
Daniel	41	−27	15.4	1.85	18.5
Evanston	43	−10	22.0	2.14	17.0
Fort Laramie	60	0	30.3	0.02	1.0
Fort Washakie	60	−8	25.2	0.20	2.0
Fort Yellowstone	45	−1	22.6	0.60	6.0
Fourbear	52	−7	27.2	0.32	7.5
Griggs	53	−16	26.5	1.30	13.0
Hyattville	56	1	28.5	.....	.....
Irma	60	0	33.1	0.60	6.0
Iron Mountain	47	5	28.8	0.03	.....
Laramie	44	−3	23.3	0.11	1.5
Leo	43	−16	21.0	0.83	9.8
Lolabama Ranch	44	−5	23.0	0.69	10.0
Lusk	48	0[e]	25.8[e]	0.38	3.8
Moore	48	2	29.0	0.07	2.4
Parkman	57[e]	−5[e]	28.4[e]	0.32	4.5
Pinebluff	53	2	29.0	T.	T.
Rawlins	52	−6	23.0	1.33	13.3
Rocksprings	.....	−16	.....	0.78	7.8
Saratoga	44	−5	22.3	1.20	12.0
South Pass City	42	−20	15.2	.....	
Thayne	38	−18	14.9	2.65	21.9
Thermopolis	48	−5	20.8	0.10	1.0
Wheatland	47	3	27.8	0.60	6.0
Porto Rico.					
Adjuntas	88	48	69.8	2.06	
Aguadilla	91	59	75.8	0.20	
Aguirre	86	64	76.1	0.67	
Arecibo	87	59	73.0	1.53	
Barros	81	51	68.7	0.10	
Bayamon	90	59	74.8	0.97	
Caguas	89	50	72.7	1.92	
Canovanas	85	67	76.2	2.19	
Cayey	88	12	70.8	1.37	
Cidra	87	50	70.6	3.10	
Coamo	88	62	74.7	T.	
Fajardo	85	66	77.3	1.33	
Guanica	90	59	74.8	0.70	
Guayama				1.29	
Hacienda Amistad	88	53	72.7	1.30	
Hacienda Perla	85	65	70.5	3.66	
Humacao	85	69	77.2	3.97	
La Isolina	86[l]	60[l]	73.8[l]	0.62	
Las Marias	91	63	76.7	0.69	
Manati	90	62	75.2	0.83	
Maunabo	87	63	75.5	4.73	
Mayaguez	89	59	74.8	2.13	
Morovis	92	58	75.5	3.30	
Rio Piedras				1.47	
San German	87	60[l]	74.8[e]	1.00	
San Salvador	85	57	72.0	0.41	
Santa Isabel	87	63	75.8	0.16	
Vieques	85	68	77.6	2.49	
Yauco	84	61	74.3	1.26	
Mexico.					
Ciudad P. Diaz	78	32	50.8	2.81	
Coatzacoalcos	85	46	69.8	5.79	
Vera Cruz	79	58	70.4	.....	
New Brunswick.					
St. John	44	−11	20.6	4.05	12.0
Isthmus of Panama.					
Albajuela †	93	68	81.3	0.20	
Bohio				3.43	
Colon				0.98	
Gamboa				0.67	
La Boca	88	72	79.9	0.55	

TABLE II.—*Climatological record of voluntary and other cooperating observers and late reports for December, 1902*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alaska.	°	°	°	*Ins.*	*Ins.*
Coal Harbor				1.20	10.5
Copper Center	35	—53	—12.4	0.20	2.0
Fort Egbert	28	—39	—21.4	0.51	7.3
Fort Gibbon	25	—64	—19.8	1.36	38.2
Fort Liscum	41	—12	16.8	4.43	83.1
Fort Yukon		—62		0.75	7.5
Juneau	40	8	23.5	4.26	
Kenai	35	—43	0.2	1.55	23.5
Skagway	45	— 2	16.0	1.44	27.2
Arkansas.					
Lonoke	68	16	41.2	5.17	T.
California.					
Caliente [1]	66	31	43.6	0.13	
Claremont	81	28	49.4	2.61	
Mutah Flat				2.25	18.0
San Miguel Island	66	41	52.6	3.60	
Santa Paula	81	38	59.3	1.16	
Snedden				1.56	10.0
Ventura				2.96	
Idaho.					
Chesterfield	45	—17	20.0	1.07	11.0
Roosevelt	44	0	21.8	5.47	41.7
Indiana.					
Winamac	48	4	26.8		
Iowa.					
Fayette	44	—16	18.0	2.76	22.0
Kansas.					
Russell	58	—11	25.4	0.85	8.5
Kentucky.					
Richmond	62	11	35.6	7.67	
Maryland.					
Pocomoke City [c]	64	18	38.5		
Massachusetts.					
Lowell *b*	52	—13	25.5		
Missouri.					
Halfway	61[4]	15[4]	35.8[4]	2.35	3.0
Nebraska.					
Ashton				0.85	8.5
North Dakota.					
Elbowoods	40	—27	—0.3	0.80	8.0
Texas.					
Austin *b* [2] [5]	73	28	47.4		
Utah.					
Logan	55	9	29.2	1.02	
Washington.					
Ritzville (near)				2.46	11.0
Wisconsin.					
Prairie du Chien *b*				3.08	14.5
Wyoming.					
Parkman	59[1]	— 8[1]	24.1[4]	0.15	3.0
Thayne	45	—18	16.8	1.42	11.4
Porto Rico.					
Hacienda Amistad	91	56	73.8	4.28	

EXPLANATION OF SIGNS.

[1] Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[c] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "[n]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

December, 1902, Arkansas, Forrest City, make maximum and mean temperature 69° and 40.2°, instead of 82° and 40.8°, respectively; Russellville, make maximum and mean temperature 68°[1] and 38.8°[4] instead of 86°[4] and 39.2°[4], respectiveiy; Washington, Port Townsend, make precipitation 3.23 instead of 3.10. November, 1902, Michigan, East Tawas, make mean temperature 43.7° instead of 48.7°. October, 1902, Indian Territory, Fort Apache, strike out all values. October, 1902, Louisiana, Port Eads, make mean temperature 74.0° instead of 75.7°.

The following changes have been made in names of stations: California, Edmanton to Meadow Valley; Kono Tayee to Lakeport (near); North Ontario to Upland; Pomona (near) to Ontario; Colorado, Arkins to Waterdale; Idaho, Thunder Mountain to Roosevelt; New York Wolcott to South Butler; New Mexico, Folsom to Eagle Rock Ranch; Las Vegas Hot Springs to Hot Springs; Washington, Ellensburg (near) to South Ellensburg.

† The temperature rose higher than has been previously recorded at Alhajuela during any January, and the barometer ranged both higher and lower as well. The rainfall throughout the Isthmus was also very light.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of January, 1903.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	17	12	7	42	n. 82 w.	35
Portland, Me	13	18	4	38	s. 82 w.	34
Concord, N. H	17	6	7	11	n. 20 w.	12
Northfield, Vt	20	36	3	11	s. 27 w.	18
Boston, Mass	11	17	7	40	s. 80 w.	34
Nantucket, Mass	13	13	8	41	w.	33
Block Island, R. I	17	15	6	38	n. 87 w.	32
Narragansett, R. I *	10	8	3	18	n. 82 w.	15
New Haven, Conn	31	7	9	26	n. 35 w.	29
Middle Atlantic States.						
Albany, N. Y	17	30	3	22	s. 56 w.	23
Binghamton, N. Y. †	4	5	7	17	s. 84 w.	10
New York, N. Y	12	15	11	38	s. 84 w.	27
Harrisburg, Pa	16	8	14	35	n. 69 w.	22
Philadelphia, Pa	18	9	12	35	n. 69 w.	25
Scranton, Pa	15	26	9	35	s. 67 w.	28
Atlantic City, N. J	20	11	9	36	n. 72 w.	28
Cape May, N. J	18	12	6	37	n. 79 w.	32
Baltimore, Md	18	12	9	36	n. 78 w.	28
Washington, D. C	21	18	6	30	n. 83 w.	24
Lynchburg, Va	17	17	9	34	w.	25
Norfolk, Va	16	19	16	25	s. 72 w.	10
Richmond, Va	16	19	12	27	s. 79 w.	15
Wytheville, Va	9	12	12	43	s. 84 w.	31
South Atlantic States.						
Asheville, N. C	30	21	9	15	n. 34 w.	11
Charlotte, N. C	20	14	15	27	n. 63 w.	13
Hatteras, N. C	21	10	14	20	n. 29 w.	12
Raleigh, N. C	23	11	9	32	n. 62 w.	26
Wilmington, N. C	20	17	11	29	n. 81 w.	18
Charleston, S. C	20	16	10	28	n. 77 w.	18
Columbia, S. C	17	19	12	29	s. 83 w.	17
Augusta, Ga	23	14	15	28	n. 55 w.	16
Savannah, Ga	21	10	12	31	n. 60 w.	22
Jacksonville, Fla	24	17	12	21	n. 52 w.	11
Florida Peninsula.						
Jupiter, Fla	20	18	16	23	n. 74 w.	7
Key West, Fla	30	8	31	9	n. 45 e.	31
Tampa, Fla	29	11	22	16	n. 18 e.	19
Eastern Gulf States.						
Atlanta, Ga	24	14	14	29	n. 56 w.	18
Macon, Ga. †	14	5	6	12	n. 34 w.	11
Pensacola, Fla. †	19	4	11	8	n. 11 e.	15
Mobile, Ala	34	16	9	15	n. 18 w.	19
Montgomery, Ala	20	14	19	21	n. 18 w.	6
Meridian, Miss †	10	6	8	13	n. 51 w.	6
Vicksburg, Miss	19	20	21	17	s. 76 e.	4
New Orleans, La	24	18	19	16	n. 27 e.	7
Western Gulf States.						
Shreveport, La	17	19	22	20	s. 45 e.	3
Fort Smith, Ark	15	8	29	22	n. 45 e.	10
Little Rock, Ark	16	21	10	27	s. 74 w.	18
Corpus Christi, Tex	22	19	18	16	n. 34 e.	4
Fort Worth, Tex	21	26	12	18	s. 39 e.	6
Galveston, Tex	20	17	21	16	n. 59 e.	6
Palestine, Tex	23	20	15	17	n. 34 w.	4
San Antonio, Tex	22	22	15	19	w.	4
Taylor, Tex †	13	12	3	10	n. 82 w.	7
Ohio Valley and Tennessee.						
Chattanooga, Tenn	18	19	13	23	s. 84 w.	10
Knoxville, Tenn	13	27	5	35	s. 65 w.	33
Memphis, Tenn	21	24	15	19	s. 53 w.	5
Nashville, Tenn	16	21	17	24	s. 54 w.	9
Lexington, Ky. †	4	17	7	12	s. 21 w.	14
Louisville, Ky	8	30	10	24	s. 32 w.	26
Evansville, Ind. †	7	11	8	10	s. 27 w.	4
Indianapolis, Ind	11	28	14	24	s. 30 w.	20
Cincinnati, Ohio	7	22	17	31	s. 43 w.	20
Columbus, Ohio	8	26	13	29	s. 42 w.	24
Pittsburg, Pa	26	15	12	32	n. 61 w.	23
Parkersburg, W. Va	13	25	11	25	s. 49 w.	18
Elkins, W. Va	9	21	5	37	s. 69 w.	34
Lower Lake Region.						
Buffalo, N. Y	4	18	7	40	s. 67 w.	36
Oswego, N. Y	13	31	9	21	s. 34 w.	22
Rochester, N. Y	6	27	8	35	s. 52 w.	34
Syracuse, N. Y	9	28	12	25	s. 34 w.	23
Erie, Pa	12	24	4	33	s. 68 w.	31
Cleveland, Ohio	4	35	15	25	s. 18 w.	33
Sandusky, Ohio †	3	13	4	17	s. 52 w.	16
Toledo, Ohio	9	29	9	31	s. 48 w.	30
Detroit, Mich	12	21	7	36	s. 73 w.	30
Upper Lake Region.						
Alpena, Mich	14	14	7	36	w.	29
Escanaba, Mich	19	14	4	37	n. 81 w.	33
Grand Haven, Mich	16	20	19	22	s. 37 w.	5
Marquette, Mich	15	14	4	36	n. 88 w.	32
Houghton, Mich. †	12	3	10	12	n. 13 w.	9
Port Huron, Mich	12	20	8	35	s. 73 w.	28
Sault Ste. Marie, Mich	16	19	24	19	s. 59 e.	6
Chicago, Ill	14	20	6	31	s. 77 w.	26
Milwaukee, Wis	14	13	5	39	n. 88 w.	34
Green Bay, Wis	17	26	9	28	s. 65 w.	21
Duluth, Minn	19	16	8	36	n. 84 w.	28

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
North Dakota.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Moorhead, Minn	26	17	17	25	n. 42 w.	12
Bismarck, N. Dak	28	9	17	21	n. 12 w.	19
Williston, N. Dak	17	23	13	22	s. 56 w.	11
Upper Mississippi Valley.						
Minneapolis, Minn *	9	7	8	14	n. 72 w.	6
St. Paul, Minn	22	19	15	27	n. 76 w.	12
La Crosse, Wis. †	13	11	4	10	n. 72 w.	6
Davenport, Iowa	9	19	13	32	s. 62 w.	22
Des Moines, Iowa	22	22	12	24	w.	12
Dubuque, Iowa	21	22	12	27	s. 86 w.	15
Keokuk, Iowa	19	22	12	27	s. 79 w.	15
Cairo, Ill	17	26	12	22	s. 48 w.	14
Springfield, Ill	20	21	7	29	s. 87 w.	22
Hannibal, Mo. †	11	9	4	14	n. 79 w.	10
St. Louis, Mo	15	25	8	26	s. 61 w.	21
Missouri Valley.						
Columbia, Mo. *	7	12	5	14	s. 61 w.	10
Kansas City, Mo	21	25	10	20	s. 68 w.	11
Springfield, Mo	18	21	12	27	s. 79 w.	15
Topeka, Kans *	12	12	3	8	w.	5
Lincoln, Nebr	21	24	8	25	s. 80 w.	17
Omaha, Nebr	20	26	6	23	s. 71 w.	18
Valentine, Nebr	20	9	6	42	n. 73 w.	38
Sioux City, Iowa †	12	11	4	14	n. 84 w.	10
Pierre, S. Dak	19	16	23	16	n. 67 e.	8
Huron, S. Dak	24	21	15	22	n. 67 w.	8
Yankton, S. Dak. †	11	7	6	16	n. 68 w.	11
Northern Slope.						
Havre, Mont	14	14	10	38	w.	28
Miles City, Mont	19	26	4	24	s. 71 w.	21
Helena, Mont	16	24	5	35	s. 75 w.	31
Kalispell, Mont	.....	.....	.....	.....	.....	.....
Rapid City, S. Dak	26	7	8	37	n. 57 w.	35
Cheyenne, Wyo	24	8	0	42	n. 69 w.	45
Lander, Wyo	11	25	18	23	s. 20 w.	15
North Platte, Nebr	12	17	6	41	s. 82 w.	35
Middle Slope.						
Denver, Colo	15	32	10	19	s. 28 w.	19
Pueblo, Colo	23	12	19	24	n. 24 w.	12
Concordia, Kans	20	24	10	21	s. 70 w.	12
Dodge, Kans	23	17	11	24	n. 65 w.	14
Wichita, Kans	25	23	10	16	n. 72 w.	6
Oklahoma, Okla	23	23	6	17	w.	11
Southern Slope.						
Abilene, Tex	17	28	8	20	s. 47 w.	16
Amarillo, Tex	24	25	6	22	s. 87 w.	16
Southern Plateau.						
El Paso, Tex	25	5	13	37	n. 50 w.	31
Santa Fe, N. Mex	35	13	17	11	n. 15 e.	23
Flagstaff, Ariz	21	11	17	24	n. 35 w.	12
Phoenix, Ariz	11	12	29	21	s. 83 e.	8
Yuma, Ariz	40	6	17	9	n. 13 e.	35
Independence, Cal	.....	.....	.....	.....	.....	.....
Middle Plateau.						
Carson City, Nev	9	29	15	26	s. 29 w.	23
Winnemucca, Nev	18	16	21	25	n. 63 w.	4
Modena, Utah	17	9	20	26	n. 37 w.	10
Salt Lake City, Utah	15	27	25	16	s. 37 e.	15
Grand Junction, Colo	10	20	32	14	s. 61 e.	21
Northern Plateau.						
Baker City, Oreg	8	40	22	15	s. 12 e.	33
Boise, Idaho	18	13	16	27	n. 66 w.	12
Lewiston, Idaho †	3	7	17	5	s. 72 e.	13
Pocatello, Idaho	1	17	29	23	s. 21 e.	17
Spokane, Wash	16	28	15	17	s. 9 w.	12
Walla Walla, Wash	6	36	9	23	s. 25 w.	33
North Pacific Coast Region.						
North Head, Wash	7	31	26	13	s. 28 e.	27
Port Crescent, Wash. *	0	13	16	9	s. 28 e.	15
Seattle, Wash	13	31	29	1	s. 57 e.	33
Tacoma, Wash	11	38	11	22	s. 22 w.	29
Tatoosh Island, Wash	9	25	28	11	s. 47 e.	23
Astoria, Oreg	15	23	30	12	s. 66 e.	20
Portland, Oreg	10	29	23	14	s. 25 e.	21
Roseburg, Oreg	10	24	25	17	s. 30 e.	16
Middle Pacific Coast Region.						
Eureka, Cal	12	30	20	16	s. 13 e.	18
Mount Tamalpais, Cal	30	12	10	26	n. 42 w.	24
Red Bluff, Cal	19	24	27	6	s. 77 e.	22
Sacramento, Cal	15	27	24	8	s. 53 e.	20
San Francisco, Cal	28	13	7	28	n. 55 w.	26
Point Reyes Light, Cal *	16	9	8	11	n. 23 w.	8
South Pacific Coast Region.						
Fresno, Cal	21	13	23	19	n. 27 e.	9
Los Angeles, Cal	20	10	23	23	n.	10
San Diego, Cal	29	7	24	21	n. 8 e.	22
San Luis Obispo, Cal	34	11	1	18	n. 36 w.	29
West Indies.						
Basseterre St. Kitts, W. I.	.....	.....	.....	.....	.....	.....
Bridgetown, Barbados	11	0	58	0	n. 79 e.	59
Havana, Cuba †	3	6	21	2	s. 81 e.	19
Puerto Principe, Cuba	25	7	25	9	n. 42 e.	24
San Juan, Porto Rico	1	27	45	1	s. 60 e.	51
Santiago de Cuba, Cuba	.....	.....	.....	.....	.....	.....

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, January, 1903.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.										5	1												1			9	12				1	29	6	T.
		A.																																0	0	A.
Arizona	56	T.																																0	0	T.
		A.																																0	0	A.
Arkansas	57	T.																																0	0	T.
		A.																																0	0	A.
California	167	T.																																29	6	T.
		A.																																0	0	A.
Colorado	81	T.																							1							1	1	3	3	T.
		A.																																0	0	A.
Connecticut	21	T.																																0	0	T.
		A.				1																												1	1	A.
Delaware	5	T.																													1			1	1	T.
		A.																																1	1	A.
Dist. of Columbia	4	T.																																0	0	T.
		A.																																0	0	A.
Florida	47	T.	1						1		1		8					2	2	4		3	2			2		6	5	7	3			0	0	T.
		A.																																54	14	A.
Georgia	55	T.																											1	7	1			0	0	T.
		A.																																9	3	A.
Idaho	34	T.																																0	0	T.
		A.																																0	0	A.
Illinois	92	T.																																0	0	T.
		A.								1					1																			2	2	A.
Indiana	58	T.		4																														4	1	T.
		A.																																0	0	A.
Indian Territory	11	T.																										5	2					7	2	T.
		A.																																0	0	A.
Iowa	149	T.																																0	0	T.
		A.								1																								1	1	A.
Kansas	77	T.						1																										1	1	T.
		A.																																0	0	A.
Kentucky	41	T.		1																											1			2	2	T.
		A.																																0	0	A.
Louisiana	46	T.										4	4										5		2		2	13	5	3	1			39	9	T.
		A.																																0	0	A.
Maine	19	T.																																0	0	T.
		A.																																0	0	A.
Maryland	48	T.																																0	0	T.
		A.																1																1	1	A.
Massachusetts	48	T.																														19		19	1	T.
		A.																																0	0	A.
Michigan	106	T.																										1	1	4	5			11	4	T.
		A.																																0	0	A.
Minnesota	67	T.																																0	0	T.
		A.																																0	0	A.
Mississippi	44	T.							1			1										1		1	2			7	13	1				27	8	T.
		A.																																0	0	A.
Missouri	95	T.																										2	1					3	2	T.
		A.																																0	0	A.
Montana	40	T.																																0	0	T.
		A.																											1					1	1	A.
Nebraska	142	T.																																0	0	T.
		A.																																0	0	A.
Nevada	40	T.																					1											1	1	T.
		A.																																0	0	A.
New Hampshire	19	T.																													1			1	1	T.
		A.																																0	0	A.
New Jersey	51	T.																																0	0	T.
		A.																																0	0	A.
New Mexico	31	T.																																0	0	T.
		A.																																0	0	A.
New York	99	T.			1																										40	5		46	3	T.
		A.																																0	0	A.
North Carolina	56	T.		4					2																1				1	3				11	5	T.
		A.																																0	0	A.
North Dakota	48	T.																																0	0	T.
		A.	1	1																														2	2	A.
Ohio	128	T.		1																											8	3		12	3	T.
		A.													1	1					1													3	3	A.
Oklahoma	23	T.																										3	1					4	2	T.
		A.																																0	0	A.
Oregon	74	T.																							2	2			1	3	6	1		15	6	T.
		A.																																0	0	A.
Pennsylvania	91	T.																												1	5			6	2	T.
		A.																																0	0	A.
Rhode Island	7	T.																														1		1	1	T.
		A.																																0	0	A.
South Carolina	46	T.		2					7	1			1																12					23	5	T.
		A.																																0	0	A.
South Dakota	56	T.																																0	0	T.
		A.																														1		1	1	A.
Tennessee	56	T.	1																										1	2	1			5	4	T.
		A.																							1					1				2	2	A.
Texas	95	T.										1										6	1					5	2					15	5	T.
		A.																																0	0	A.
Utah	47	T.																						2										2	1	T.
		A.																																0	0	A.
Vermont	16	T.																																0	0	T.
		A.																																0	0	A.
Virginia	50	T.																											1		1			2	2	T.
		A.																																0	0	A.
Washington	64	T.																																0	0	T.
		A.																																0	0	A.
West Virginia	43	T.																												2	1			3	2	T.
		A.																											1					1	1	A.
Wisconsin	60	T.																											1					1	1	T.
		A.																																0	0	A.
Wyoming	31	T.																											1					1	1	T.
		A.																																0	0	A.
Sums	2,893	T.	2	12	1	0	0	1	11	1	1	11	14	0	0	0	0	2	1	4	0	10	9	3	9	4	2	52	54	48	76	34	2	372	....	T.
		A.	1	1	0	1	0	0	0	2	0	0	0	2	1	0	0	1	0	0	1	0	0	1	1	0	0	0	1	1	1	0	0	15	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during January, 1903, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	2-3			0.48														*			
Alpena, Mich.	28-29			0.86														*			
Asheville, N. C.	2			0.56														0.18			
Atlanta, Ga.	27			0.68														0.29			
Atlantic City, N. J.	2-3			1.36														0.68			
Augusta, Ga.	27			1.44														0.53			
Baltimore, Md.	2-3			1.58														*			
Binghamton, N. Y.	21			0.93														*			
Bismarck, N. Dak.	27-28			0.74														*			
Block Island, R. I.	11			1.25														*			
Boise, Idaho.	21-22			1.42														0.11			
Boston, Mass.	21			1.14														0.40			
Buffalo, N. Y.	2-3			0.51														0.11			
Cairo, Ill.	1-2			1.17														0.23			
Charleston, S. C.	2			1.03														0.69			
Charlotte, N. C.	1-2			1.27														0.36			
Chattanooga, Tenn.	1-2			0.62														0.24			
Chicago, Ill.	2-3			0.35														*			
Cincinnati, Ohio.	2			0.86														0.24			
Cleveland, Ohio.	2-3			0.42														0.06			
Columbia, Mo.	1-2			0.74														0.08			
Columbia, S. C.	2	D. N.	7:30 p. m.	1.32	12:50 p. m.	1:20 p. m.	0.27	0.05	0.17	0.42	0.66	0.74	0.92	0.96							
Columbus, Ohio.	2-3			0.82														0.21			
Corpus Christi, Tex.	15-16			0.62														0.38			
Davenport, Iowa.	2-3			0.46														*			
Denver, Colo.	10-11			0.10														*			
Des Moines, Iowa.	10-11			0.06														*			
Detroit, Mich.	11			0.88														*			
Dodge, Kans.	4			0.04														*			
Dubuque, Iowa.	4			0.04														*			
Duluth, Minn.	27-29			0.40														*			
Eastport, Me.	11-12			0.96														0.41			
Elkins, W. Va.	11-12			0.73														0.17			
Erie, Pa.	2-3			0.51														*			
Escanaba, Mich.	28-30			0.51														0.14			
Evansville, Ind.	11			0.55														*			
Fort Smith, Ark.	27			0.58														0.31			
Fort Worth, Tex.	20-21			0.67														0.14			
Galveston, Tex.	10	D. N.	7:20 a. m.	1.08	6:10 a. m.	6:48 a. m.	0.42	0.04	0.09	0.11	0.21	0.46	0.49	0.56	0.64						
Grand Haven, Mich.	2-4			0.51														*			
Grand Junction, Colo.																					
Green Bay, Wis.	6-8			0.41														*			
Harrisburg, Pa.	2-3			1.23														0.25			
Hatteras, N. C.	20-21			1.44														0.27			
Huron, S. Dak.	10			0.03														*			
Indianapolis, Ind.	2-3			1.16														0.20			
Jacksonville, Fla.	17			1.09														0.38			
Jupiter, Fla.	20	12:15 a. m.	5:30 p. m.	3.33	1:50 p. m.	2:40 p. m.	2.01	0.04	0.08	0.15	0.34	0.49	0.60	0.66	0.67	0.77	0.89	0.93			
Do	26	6:20 a. m.	10:58 a. m.	1.51	8:52 a. m.	9:30 a. m.	0.13	0.18	0.47	0.67	0.87	1.02	1.11	1.13	1.21	1.26					
Kalispell, Mont.	2-3			0.53														*			
Kansas City, Mo.	23			0.24														*			
Key West, Fla.	20			1.05														0.50			
Knoxville, Tenn.	23-24			0.45														0.29			
La Crosse, Wis.	10			0.05														*			
Lewiston, Idaho.	2			0.41														0.08			
Lexington, Ky.	11			0.48														*			
Lincoln, Nebr.	10			0.21														*			
Little Rock, Ark.	10-11			0.67														0.33			
Los Angeles, Cal.	27-28			1.72														0.22			
Louisville, Ky.	2			1.00														0.17			
Lynchburg, Va.	2			2.36														0.44			
Macon, Ga.	11			0.51														0.22			
Memphis, Tenn.	1-2			1.35														0.32			
Meridian, Miss.	10-11	8:30 a. m.	5:00 a. m.	2.85	1:50 a. m.	2:20 a. m.	1.62	0.07	0.16	0.25	0.35	0.45	0.53	0.55							
Milwaukee, Wis.	11			0.17														*			
Montgomery, Ala.	1-2	7:20 p. m.	7:20 a. m.	1.06	3:40 a. m.	4:10 a. m.	0.35	0.04	0.12	0.29	0.42	0.58	0.66								
Nantucket, Mass.	21			0.60														0.24			
Nashville, Tenn.	1:			0.41														0.18			
New Haven, Conn.	2-3			0.70														0.39			
New Orleans, La.	1-2			0.94														0.37			
New York, N. Y.	2-3			1.05														0.36			
Norfolk, Va.	11			0.25														0.21			
Northfield, Vt.	21			0.76														*			
North Head, Wash.	1-3			3.19														0.20			
Oklahoma, Okla.	20			0.07														0.03			
Omaha, Nebr.	10			0.03														0.01			
Palestine, Tex.	26			0.52																	
Parkersburg, W. Va.	2-3			0.92							0.24							0.21			
Pensacola, Fla.	28	7:40 a. m.	12:25 p. m.	2.86	7:41 a. m.	9:30 a. m.	T.	0.11	0.36	0.41	0.43	0.46	0.64	1.04	1.13	1.27	1.35	1.64	1.85	2.39	2.58
Philadelphia, Pa.	2-3			1.17														0.32			
Pittsburg, Pa.	20-21			0.56														*			
Pocatello, Idaho.	26-28			0.72														*			
Portland, Me.	21			2.40														0.66			
Portland, Oreg.	23-24			1.63														0.17			
Pueblo, Colo.	10-11			0.20														*			
Raleigh, N. C.	1-2			0.78														0.35			
Richmond, Va.	2-3			1.67														0.52			
Rochester, N. Y.	2-3			0.60														*			
Sacramento, Cal.	27			1.40														0.25			
St. Louis, Mo.	1-2			0.63														0.15			
St. Paul, Minn.	6-7			0.11														0.02			
Salt Lake City, Utah.	27-28			1.16														*			
San Antonio, Cal.	15-16			0.68														0.16			
San Diego, Cal.	31			0.30														0.20			
Sandusky, Ohio.	2-3			0.50														*			
San Francisco, Cal.	22-23			0.65														0.34			
Savannah, Ga.	2			0.56														0.47			
Scranton, Pa.	2-3			0.68														0.21			
Seattle, Wash.	20			0.19														0.14			
Shreveport, La.	26-27			0.95														0.67			
Spokane, Wash.	2			0.55														*			
Springfield, Ill.	2			0.40														*			
Springfield, Mo.	1-2			0.75														*			

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Tampa, Fla	26	4:35 p. m.	10:20 p. m.	0.90	7:40 p. m.	8:23 p. m.	0.03	0.12	0.33	0.46	0.56	0.61	0.65	0.67	0.80	0.85	.....	.....	.....	.....	.....
Taylor, Tex.	1	.....	.....	0.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.11	.....	.....	.....
Toledo, Ohio	11	.....	.....	0.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Topeka, Kan	23	.....	.....	0.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Valentine, Nebr	22–23	.....	.....	0.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Vicksburg, Miss	1–2	.....	.....	2.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.44	.....	.....	.....
Washington, D. C	2–3	.....	.....	1.86	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.45	.....	.....	.....
Wilmington, N. C	2	.....	.....	1.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.58	.....	.....	.....
Yankton, S. Dak	29	.....	.....	0.08	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*	.....	.....	.....
Bridgetown, Barbados	16	.....	.....	0.18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
Havana, Cuba	18	9:00 a. m.	12:35 p. m.	1.02	10:25 a. m.	10:38 a. m.	0.24	0.24	0.58	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Puerto Principe, Cuba	3	6:05 p. m.	7:58 p. m.	1.06	6:08 p. m.	6:35 p. m.	0.01	0.14	0.42	0.63	0.77	0.88	0.93	.....	.....	.....	.....	.....	.....	.....	.....
San Juan, Porto Rico	31	.....	.....	0.73	.....	.....	.....	.....	.....	.....	.....	0.26	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Self-register not working.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, January, 1903.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.70	29.74	—.19	21.0	+ 0.5	28.9	13.2	6.18	+1.08	34.0
Sydney, C. B. I	29.68	29.79	—.18	25.3	+ 3.5	33.1	17.6	5.09	—0.68	16.8
Halifax, N. S	29.74	29.79	—.20	24.5	+ 1.1	32.5	16.4	4.71	—0.29	11.8
Grand Manan, N. B	29.76	29.83	—.17	28.3	+ 2.0	34.9	21.7	5.30	—0.11	13.5
Yarmouth, N. S	29.71	29.75	—.21	17.9	+ 0.9	25.8	10.0	2.85	—1.11	20.7
Charlottetown, P. E. I	29.72	29.75	—.22	11.8	+ 2.0	22.5	1.2	3.28	—0.31	20.3
Chatham, N. B	29.75	29.77	—.21	12.4	+ 4.4	20.0	4.7	4.26	+1.41	42.1
Father Point, Que	29.49	29.83	—.19	11.0	+ 1.9	18.5	3.5	3.37	—0.64	29.0
Quebec, Que	29.66	29.89	—.15	14.3	+ 2.6	21.6	7.0	4.08	+0.35	33.4
Montreal, Que	29.27	29.92	—.10	4.9	— 1.5	18.1	— 8.3	1.34	—0.98	13.0
Bissett, Ont	29.60	29.94	—.09	11.8	+ 2.2	20.4	3.2	2.82	—0.17	18.6
Ottawa, Ont	29.58	29.92	—.13	19.8	+ 2.7	27.7	11.8	2.65	—0.80	17.8
Kingston, Ont	29.52	29.92	—.13	23.1	+ 1.7	29.8	16.3	2.71	—0.21	20.5
Toronto, Ont	28.53	29.92	—.09	1.0	+ 1.4	15.2	—13.1	1.36	—0.33	13.6
White River, Ont	29.27	29.94	—.13	23.3	+ 1.1	30.2	16.5	3.11	+0.12	23.9
Port Stanley, Ont	29.15	29.88	—.15	22.5	+ 2.1	29.9	15.1	3.82	—0.23	32.7
Parry Sound, Ont	29.15	29.88	—.13	16.4	+ 2.6	25.7	7.0	3.47	— 0.61	23.3
Port Arthur, Ont	29.18	29.92	—.15	7.8	+ 4.7	17.9	— 2.2	0.23	— 0.59	2.3
Winnipeg, Man	29.11	30.00	—.11	2.3	+ 9.1	13.6	— 9.0	0.28	— 0.60	2.8
Minnedosa, Man	28.03	29.95	—.15	3.5	+10.7	15.1	— 8.1	1.13	+ 0.33	11.3
Qu'Appelle, Assin	27.58	29.94	—.14	5.9	+ 9.7	15.7	— 4.0	1.10	+ 0.60	11.0
Medicine Hat, Assin	27.60	29.97	—.10	18.9	+13.4	29.8	8.1	0.25	— 0.32	2.5
Swift Current, Assin	27.29	29.98	—.11	15.1	+12.0	24.4	5.8	0.70	+ 0.06	6.6
Calgary, Alberta	26.22	29.86	—.17	21.6	+13.2	31.3	11.9	0.05	— 0.48	0.5
Banff, Alberta	25.21	29.99	—.01	18.3	+ 6.2	26.3	10.3	0.94	— 0.25	9.4
Edmonton, Alberta	27.32	29.91	—.12	12.8	+11.0	22.5	3.1	0.97	+ 0.29	9.7
Prince Albert, Sask	28.31	29.95	—.14	2.5	+10.9	13.3	— 8.2	0.59	— 0.38	5.9
Battleford, Sask	28.17	30.02	—.06	2.7	+ 8.6	12.5	— 7.2	0.89	+ 0.49	8.9
Kamloops, B. C	28.74	29.99	+.03	28.1	+ 5.1	33.8	22.5	0.35	— 0.47	3.5
Victoria, B. C	29.89	29.99	+.02	41.9	+ 3.4	45.2	38.6	3.94	— 1.45	0.0
Barkerville, B. C	25.53	29.94	+.05	19.3	+ 1.5	26.9	11.7	1.40	— 1.20	14.0
Hamilton, Bermuda	29.92	30.09	—.04	64.2	+ 2.2	69.1	59.3	4.37	— 0.57	0.0

TABLE VII.—*Heights of rivers referred to zeros of gages, January, 1903.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.[1]	1,954	14	.....	.....	.....	.....	.....	.....
Red Wing, Minn.[1]	1,914	14	.....	.....	.....	.....	.....	.....
Reeds Landing, Minn.[1]	1,884	12	.....	.....	.....	.....	.....	.....
La Crosse, Wis.[1]	1,819	12	.....	.....	.....	.....	.....	.....
Prairie du Chien, Wis.[1]	1,759	18	.....	.....	.....	.....	.....	.....
Dubuque, Iowa.[1]	1,699	15	.....	.....	.....	.....	.....	.....
Leclaire, Iowa.[1]	1,609	10	.....	.....	.....	.....	.....	.....
Davenport, Iowa[2]	1,593	15	.....	.....	.....	.....	.....	.....
Muscatine, Iowa	1,562	16	8.4	2	4.5	25	6.1	3.9
Galland, Iowa	1,472	8	3.5	12	1.4	27–29	2.4	2.1
Keokuk, Iowa	1,463	15	4.2	6, 7	2.3	27, 28, 30	3.2	1.9
Hannibal, Mo	1,402	13	6.0	19–21	4.0	1–3, 12–15	4.9	2.0
Grafton, Ill	1,306	23	7.9	31	5.3	15	6.7	2.6
St. Louis, Mo	1,264	30	10.4	29	4.5	16	7.4	5.9
Chester, Ill	1,189	30	8.5	30, 31	4.1	16, 17	6.1	4.4
New Madrid, Mo	1,003	34	27.2	1	14.4	29	20.1	12.8
Memphis, Tenn	843	33	28.8	1	10.4	30, 31	18.4	18.4
Helena, Ark	767	42	38.8	1	16.9	31	27.6	21.9
Arkansas City, Ark	635	42	41.4	3	21.6	31	33.4	19.8
Greenville, Miss	595	42	35.6	3	17.3	31	28.5	18.3
Vicksburg, Miss	474	45	39.8	6	23.0	31	34.0	16.8
New Orleans, La	108	16	15.0	11	11.0	31	13.9	4.0
James River.								
Huron, S. Dak.[1]	210	9	.....	.....	.....	.....	.....	.....
Missouri River.								
Bismarck, N. Dak	1,309	14	4.4	20–24	2.9	2–4	3.9	1.5
Pierre, S. Dak.[1]	1,114	14	.....	.....	.....	.....	.....	.....
Sioux City, Iowa[1]	784	19	.....	.....	.....	.....	.....	.....
Omaha, Nebr.[1]	669	18	.....	.....	.....	.....	.....	.....
St. Joseph, Mo	481	10	1.4	3, 14	0.2	9	0.8	1.2
Kansas City, Mo	388	21	12.9	3	7.6	13	9.6	5.3
Boonville, Mo	199	20	8.0	29	5.1	16	6.4	2.9
Hermann, Mo	103	24	8.1	28	4.5	14	6.0	3.6
Illinois River.								
Peoria, Ill	135	14	14.1	1	12.3	25–27	13.0	1.8
Youghiogheny River.								
Confluence, Pa	59	10	8.3	30	1.5	27	3.1	6.8
West Newton, Pa.[6]	15	23	14.5	29	1.8	11	6.1	12.7
Allegheny River.								
Warren, Pa[4]	177	14	7.1	31	1.5	2, 3	2.9	5.6
Oil City, Pa	123	13	9.4	30	1.8	27, 28	3.0	7.6
Parker, Pa	73	20	10.0	30	1.7	26, 27	3.0	8.3
Freeport, Pa[5]	29	20	20.0	30	4.7	13	9.0	15.3
Clarion River.								
Clarion, Pa	32	10	9.0	30	2.0	2	3.6	7.0
Monongahela River.								
Weston, W. Va.[7]	161	18	6.0	3	2.8	20	3.8	3.2
Fairmont, W. Va	119	25	12.0	4	1.6	20	4.7	10.4
Greensboro, Pa	81	18	16.4	4	8.0	21	10.2	8.4
Lock No. 4, Pa	40	28	22.1	4	8.0	11	11.4	14.1
Conemaugh River.								
Johnstown, Pa	64	7	9.0	30	2.0	26, 27	3.2	7.0
Red Bank Creek.								
Brookville, Pa	35	8	5.5	30	1.0	11–29	1.4	4.5
Beaver River.								
Elwood Junction, Pa.[8]	10	14	.....	.....	.....	.....	.....	.....
Great Kanawha, River.								
Charleston, W. Va	58	30	17.7	4	4.8	20, 21	6.9	12.9
Little Kanawha River.								
Glenville, W. Va	103	20	8.8	3	0.6	31	2.6	8.2
New River.								
Radford, Va	155	14	3.0	3, 4	—0.2	1	1.4	3.2
Hinton, W. Va	95	14	8.8	3	2.0	14, 15	3.2	6.8
Cheat River.								
Rowlesburg, W. Va.[9]	36	14	.....	.....	.....	.....	.....	.....
Ohio River.								
Pittsburg, Pa	966	22	21.0	31	3.2	21, 27	6.7	17.8
Davis Island Dam, Pa	960	25	19.7	31	5.4	21, 27	8.2	14.3
Beaver Dam, Pa	925	27	29.3	31	6.9	27	11.3	22.4
Wheeling, W. Va	875	36	25.5	31	6.9	27	10.9	18.6
Parkersburg, W. Va	785	36	24.0	6	7.5	12	11.9	16.5

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ohio River—Continued.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Point Pleasant, W. Va	705	39	29.9	6	9.2	21	15.1	20.7
Huntington, W. Va	660	50	33.2	7	13.2	21	19.2	20.0
Catlettsburg, Ky	651	50	34.2	7	12.8	21	19.2	21.4
Portsmouth, Ohio	612	50	35.6	7	13.8	21, 22	20.5	21.8
Cincinnati, Ohio	499	50	37.0	8	14.7	22, 23	23.1	22.3
Madison, Ind	413	46	30.6	8	13.9	24	21.0	26.7
Louisville, Ky	367	28	12.4	9	7.1	24, 25	9.3	5.3
Evansville, Ind	184	35	29.6	10, 11	12.7	26	20.6	16.9
Paducah, Ky	47	40	26.2	1	12.1	28	19.8	14.1
Cairo, Ill	1,073	45	32.3	1	17.4	28	24.7	14.9
Muskingum River.								
Zanesville, Ohio	70	20	17.8	30	7.3	2	11.3	10.5
Scioto River.								
Columbus, Ohio [9]	110	17	.....	.....	.....	.....	.....	.....
Miami River.								
Dayton, Ohio [10]	77	18	.....	.....	.....	.....	.....	.....
Wabash River.								
Mount Carmel, Ill. [11]	50	15	13.4	31	4.8	17	8.4	8.6
Licking River.								
Falmouth, Ky. [12]	30	25	10.3	3, 4	2.5	23	5.0	7.8
Kentucky River.								
High Bridge, Ky	117	17	14.9	4	10.3	23	12.0	4.6
Frankfort, Ky	65	31	12.0	5	7.0	22-25	8.2	5.0
Hiwassee River.								
Charleston, Tenn	18	22	4.2	12	1.6	23, 24, 27	2.3	2.6
Holston River.								
Rogersville, Tenn	103	14	4.8	4	2.0	2, 21	2.6	2.8
French Broad River.								
Leadvale, Tenn	70	15	1.0	5, 12	—0.8	19	0.0	1.8
Clinch River.								
Speers Ferry, Va	156	20	3.6	4	0.3	1	1.0	3.3
Clinton, Tenn	52	25	10.5	6	5.2	22, 23	6.9	5.3
Tennessee River.								
Knoxville, Tenn	635	29	5.2	5	1.6	22	2.4	3.6
Kingston, Tenn	556	25	5.7	7	2.3	24	3.5	3.4
Chattanooga, Tenn	452	33	8.2	7	4.0	24, 25	5.5	4.2
Bridgeport, Ala	402	24	6.1	8	2.5	24, 25	3.9	3.6
Florence, Ala	255	16	6.0	9, 16	2.8	27	4.7	3.2
Riverton, Ala	225	25	9.2	13	3.6	27	6.6	5.6
Johnsonville, Tenn	95	24	11.5	5	5.3	27	8.6	6.2
Cumberland River.								
Burnside, Ky	516	50	14.9	13	3.2	24	7.2	11.7
Carthage, Tenn	305	40	13.7	15	4.3	25	8.5	9.4
Nashville, Tenn	189	40	18.0	7	6.0	25	12.6	12.0
Clarksville, Tenn	126	42	21.9	4	9.7	27	15.9	12.2
Arkansas River.								
Wichita, Kans	832	10	1.6	2-4, 6, 31	1.1	18	1.4	0.5
Webbers Falls, Ind. T	465	23	5.0	5, 6	3.3	24-26, 30, 31	3.9	1.7
Fort Smith, Ark	403	22	6.8	6	3.5	27	4.7	3.3
Dardanelle, Ark	256	21	7.0	7	3.5	23-27	4.9	3.5
Little Rock, Ark	176	23	9.5	8	4.8	25	7.3	4.7
White River.								
Newport, Ark	150	26	12.0	1	3.7	26, 27	7.3	8.3
Yazoo River.								
Yazoo City, Miss	80	25	19.4	11, 12	16.4	1	18.4	3.0
Red River.								
Arthur City, Tex	638	27	9.6	4	5.7	29, 30	6.6	3.9
Fulton, Ark. [13]	515	28	16.0	7	8.8	28, 31	11.4	7.2
Shreveport, La	327	29	27.6	1	8.0	31	15.4	19.6
Alexandria, La	118	33	32.0	2.3	13.5	31	23.2	18.5
Ouachita River.								
Camden, Ark	304	39	20.6	5, 6	9.5	26, 27	14.3	11.1
Monroe, La	122	40	33.7	12	28.5	31	31.8	5.2
Atchafalaya River.								
Melville, La	100	31	32.8	10, 11	27.7	31	31.5	5.1
Penobscot River.								
Mattawamkeag, Me. [3]	87	.....	.....	.....	.....	.....	.....	.....
Montague, Me. [1]	60	.....	.....	.....	.....	.....	.....	.....
Kennebec River.								
Solon, Me	86	.....	1.0	19, 25	0.2	10	0.6	0.8
Winslow, Me	46	.....	5.2	25	4.1	12, 15, 21	4.7	1.1
Merrimac River.								
Concord, N. H. [1]	94	.....	.....	.....	.....	.....	.....	.....
Manchester, N. H	68	.....	4.2	25	1.9	12	3.2	2.3
Connecticut River.								
Wells River, Vt. [1]	255	.....	.....	.....	.....	.....	.....	.....
White River Junction, Vt. [1]	209	.....	.....	.....	.....	.....	.....	.....
Bellows Falls, Vt	170	12	4.1	4	2.1	29	2.7	2.0
Holyoke, Mass	84	9	3.6	4, 5	1.6	20, 21	2.4	2.0
Hartford, Conn	50	13	9.2	12	6.1	2	7.6	3.1
Housatonic River.								
Gaylordsville, Conn [14]	50	15	6.1	31	4.2	19	5.2	1.9

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Susquehanna River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Binghamton, N. Y	306	16	11.1	31	4.1	2	6.1	7.0
Towanda, Pa. [15]	262	16	10.8	30, 31	2.2	12	4.0	8.6
Wilkesbarre, Pa	183	17	17.7	31	6.8	10	9.9	10.9
Harrisburg, Pa	69	17	8.1	31	2.2	14, 15	4.0	5.9
West Branch Susquehanna.								
Lock Haven, Pa. [16]	65	12	.....	.....	.....	.....	.....	.....
Williamsport, Pa	39	20	11.0	31	2.2	10, 11	3.8	8.8
Juniata River.								
Huntingdon, Pa. [17]	90	24	.....	.....	.....	.....	.....	.....
Shenandoah River.								
Riverton, Va [18]	58	22	8.8	4	—0.5	1	1.6	9.3
Potomac River.								
Cumberland, Md. [18]	290	8	6.5	4	2.7	1, 2	4.0	3.8
Harpers Ferry, W. Va	172	18	12.7	4	2.0	20, 21	4.7	10.7
James River.								
Lynchburg, Va	260	18	7.6	4	1.0	20	2.8	6.6
Richmond, Va	111	12	11.8	4	0.0	14	2.1	11.8
Dan River.								
Danville, Va	55	8	6.8	3	0.0	19, 20	0.9	6.8
Roanoke River.								
Clarksville, Va	196	12	13.9	5	3.0	2	5.9	10.0
Weldon, N. C	129	30	36.5	6	10.2	2	15.8	26.3
Cape Fear River.								
Fayetteville, N. C	112	38	24.6	5	5.6	2	10.6	19.0
Edisto River.								
Edisto, S. C	75	6	4.6	14-16, 31	3.7	6, 7	4.2	0.9
Pedee River.								
Cheraw, S. C	149	27	29.1	5	3.8	2	8.7	25.3
Black River.								
Kingstree, S. C	52	12	7.2	31	4.4	2, 3	6.4	2.8
Lynch Creek.								
Effingham, S. C	35	12	9.0	14	3.6	1	6.0	5.4
Santee River.								
St. Stephens, S. C	97	12	9.5	14	7.5	31	8.2	2.0
Congaree River.								
Columbia, S. C	37	15	10.3	4	0.9	26	2.7	9.4
Wateree River.								
Camden, S. C	45	24	27.0	4	6.3	20	10.4	20.7
Waccamaw River.								
Conway, S. C	40	7	5.5	22	4.2	2, 9, 10	4.9	1.3
Savannah River.								
Calhoun Falls, S. C	347	15	4.0	3, 4, 12	2.7	27	3.4	1.3
Augusta, Ga	268	32	14.2	5, 13	8.9	25	10.4	5.3
Broad River.								
Carlton, Ga	30	11	4.9	12	2.7	23	3.2	2.2
Flint River.								
Albany, Ga	80	20	5.4	14-16	3.0	3	4.3	2.4
Chattahoochee River.								
Oakdale, Ga	305	18	4.9	13	1.9	23	2.8	3.0
Westpoint, Ga	239	20	5.2	14	3.1	23, 24	3.7	2.1
Eufaula, Ala	90	40	8.6	13	3.8	23, 24	5.5	4.8
Ocmulgee River.								
Macon, Ga	125	18	5.4	13	3.8	20-24	4.5	1.6
Oconee River.								
Dublin, Ga	79	30	6.0	29	0.9	2	3.4	5.1
Coosa River.								
Rome, Ga	271	30	5.0	4, 12, 13	2.0	22-27	3.1	3.0
Gadsden, Ga	144	18	8.0	14	1.5	27	4.0	6.5
Alabama River.								
Montgomery, Ala	265	35	9.9	14	3.9	27	6.6	6.0
Selma, Ala	212	35	13.0	6, 15	5.2	26, 27	8.6	7.8
Tombigbee River.								
Columbus, Miss	303	33	12.2	4, 6	1.9	26, 27	7.6	10.3
Demopolis, Ala	155	35	32.3	15	10.0	27	22.6	22.3
Black Warrior River.								
Tuscaloosa, Ala	90	43	28.4	13	8.0	27	15.2	20.4
Brazos River.								
Kopperl, Tex	369	21	1.0	21	—0.6	26-31	—0.4	1.6
Waco, Tex	301	24	6.2	22	3.3	20, 21	3.8	2.9
Booth, Tex	76	39	17.0	3	1.0	1	7.4	16.0
Red River of the North.								
Moorhead, Minn. [1]	418	26	.....	.....	.....	.....	.....	.....
Columbia River.								
Umatilla, Oreg	270	25	6.7	27	0.9	23	3.3	5.8
The Dalles, Oreg	166	40	10.8	22	2.8	20	5.7	8.0
Willamette River.								
Albany, Oreg	118	20	31.5	26	3.9	19	10.7	27.6
Portland, Oreg	12	15	19.3	28	4.5	20	9.6	14.8
Sacramento River.								
Red Bluff, Cal	265	23	24.4	25	1.8	20	6.8	22.6
Sacramento, Cal	64	29	23.2	28	12.6	22	16.5	10.6

[1] Frozen. [2] Frozen 25 days. [3] Frozen 23 days. [4] Frozen 17 days. [5] Frozen 16 days. [6] Frozen 18 days. [7] Frozen 3 days. [8] Frozen 22 days. [9] Frozen 20 days. [10] Frozen 19 days. [11] Frozen 7 days. [12] Frozen 6 days. [13] Frozen 24 days. [14] Frozen 1 day. [15] Frozen 4 days. [16] Frozen 26 days. [17] Frozen 21 days. [18] Frozen 2 days. [19] 27 days.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during January, 1903.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Duration, 1903.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.17	26.14	62.0	61.5	84	85	.00	T.	0.00
2 a. m	26.16	26.12	61.9	61.2	83	85	.00	.00	0.00
3 a. m	26.14	26.11	61.3	60.8	84	86	.02	T.	0.75
4 a. m	26.13	26.11	61.0	60.4	84	86	.01	.01	1.00
5 a. m	26.13	26.11	61.0	60.3	85	86	.02	.01	1.00
6 a. m	26.13	26.13	60.3	59.0	84	86	.00	.01	0.00
7 a. m	26.15	26.13	60.3	59.2	84	86	.00	.02	0.00
8 a. m	26.16	26.15	60.6	61.9	76	81	.00	.01	0.00
9 a. m	26.18	26.17	66.9	66.7	66	73	.00	.02	0.00
10 a. m	26.19	26.17	70.5	70.2	63	68	.00	.00	0.00
11 a. m	26.18	26.16	72.5	72.5	56	64	.00	.00	0.00
Noon	26.16	26.15	74.7	73.8	53	62	.00	T.	0.00
1 p. m	26.15	26.13	76.1	74.8	56	61	.00	.02	0.00
2 p. m	26.12	26.10	76.3	74.8	50	61	.00	.01	0.00
3 p. m	26.10	26.09	75.6	74.1	54	63	.00	.02	0.00
4 p. m	26.10	26.08	74.1	72.6	61	65	.10	.08	1.00
5 p. m	26.10	26.09	70.5	70.3	66	69	.01	.11	0.50
6 p. m	26.11	26.10	68.2	67.5	72	75	.00	.04	0.00
7 p. m	26.13	26.11	66.2	65.3	79	79	.01	.02	0.50
8 p. m	26.15	26.13	65.1	64.2	81	82	.02	.04	0.75
9 p. m	26.16	26.15	64.6	63.7	81	82	.00	T.	0.00
10 p. m	26.18	26.16	63.9	63.0	83	83	.00	.02	0.00
11 p. m	26.18	26.16	63.3	62.4	84	85	.00	.02	0.00
Midnight	26.18	26.15	63.0	61.9	83	85	.00	T.	0.00
Mean	26.15	26.13	66.6	65.8	73	77	.....	.....	.....
Minimum	25.99	25.98	53.4	49.5	20	.....	.....	.....	.....
Maximum	26.30	26.30	85.5	86.5	100	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.19	.46	5.50

REMARKS.—At San José the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	6.24	8.28	33	39	70.9	71.6	72.0	70.7	70.5
8 a. m	23.91	22.43	.....	.....	.....	.....	.....	.....	.....
9 a. m	22.95	22.55	.....	.....	.....	.....	.....	.....	.....
10 a. m	21.19	20.73	61	44	71.2	71.6	72.1	71.1	.....
11 a. m	18.80	19.74	.....	.....	.....	.....	.....	.....	.....
Noon	19.74	18.42	.....	.....	.....	.....	.....	.....	.....
1 p. m	18.84	17.99	63	53	72.5	72.0	72.1	71.1	.....
2 p. m	21.21	19.74	.....	.....	.....	.....	.....	.....	.....
3 p. m	21.05	19.23	.....	.....	.....	.....	.....	.....	.....
4 p. m	18.13	17.44	63	57	72.7	72.3	72.1	70.9	.....
5 p. m	13.44	12.70	.....	.....	.....	.....	.....	.....	.....
6 p. m	2.76	2.54	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	65	55	72.0	72.5	72.1	70.8	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	49	44	72.5	72.3	72.1	70.7	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	50	49	72.0	72.1	72.1	70.9	70.5
Total	208.26	201.79	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, January, 1903.*

Stations.	Height above sea level.	Observed, 1902.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	197	6.50	14	2	16.46	21
Boca Banano	10	12.01	14	7	12.91	20
Port Limon	10	15.39	19	4	14.80	19
Swamp Mouth	10	13.38	13	2	9.65	19
Zent	66	9.72	16	1	6.10	17
Siquirres	197	9.17	8	3	18.39	15
Dos Novillos	400	7.16	12	.....	.....	.....
Guapiles	984	7.52	20	2	15.08	16
Cariblanco (Sarapiquí)	2,740	16.22	21	4	21.61	23
San Carlos	528	6.93	14	4	10.00	18
Las Lomas	873	8.62	13	1	20.51	16
Peralta	1,089	6.14	13	4	10.19	17
Turrialba	2,034	.....	.....	7	8.86	16
Juan Viñas	3,412	3.19	7	6	8.94	16
Santiago	3,609	3.27	10	1	8.03	22
Paraiso	4,383	1.46	3	1	4.33	20
Cachi	3,346	11.26	18	1	3.03	23
Las Concavas	4,386	10.03	13	1	2.52	24
Tres Rios	4,265	2.32	4	13	0.35	2
San Isidro Arenilla	.....	.....	.....	.....	.....	.....
San Francisco Guadalupe	3,894	0.24	2	6	0.79	5
San Jose	3,806	1.93	5	14	0.43	3
La Verbena	3,740	2.24	4	5	0.16	2
Nuestro Amo	2,595	0.00	0	7	0.00	0
Alajuela	3,117	0.00	0	2	0.00	0
San Isidro Alajuela	4,416	0.00	0	1	0.00	0

TABLE 4.—*Observations taken at Port Limon and Zent, January, 1903.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	° *F.*	° *F.*	° *F.*	%
Port Limon	29.70	29.98	29.81	64.4	87.8	76.8	84
Zent	.....	.....	.....	63.5	93.2	76.6	91

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	6 inches.	12 inches.	24 inches.
	%	*Hours.*	*Inches.*		° *F.*	° *F.*	° *F.*
Port Limon	.....	.....	15.39	19	.....	.....	.....
Zent	75	150.70	9.72	16	77.4	77.2	77.1

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

January, 1903.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inches.*	° *F.*	° *F.*	° *F.*	%	*Ins.*		
Chihuahua	4,684	25.25	75.2	29.3	56.8	50	0.18	e.	.....
Guadalajara (Obs. del. Est.)	5,186	24.92	84.2	39.2	56.8	63	5.20	nw.	.....
Guanajuato	6,640	23.68	77.0	38.1	54.0	60	2.46	ne.	.....
Leon (Guanajuato)	5,906	24.25	74.1	33.4	52.9	64	2.14	ne.	.....
Mazatlan	25	29.91	81.7	56.7	70.0	65	1.37	nw.	.....
Merida	50	.....	.....	.....	.....	.....	.....	.....	.....
Mexico (Obs. Cent.)	7,472	23.01	71.1	39.2	54.5	50	T.	w.	sw.
Mexico (E. N. Agric.)	7,442	.....	.....	.....	.....	.....	.....	.....	.....
Monterey (Seminario)	1,626	28.20	97.9	36.1	56.1	68	1.21	e.	.....
Morelia (Seminario)	6,401	23.89	73.4	38.8	54.0	68	2.27	s.	s.
Puebla (Col. Cath.)	7,108	23.33	72.9	40.6	56.5	57	.....	ene., sw.	.....
Puebla (Col. d Est.)	7,118	23.31	73.9	35.6	54.0	58	.....	ene.	.....
Queretario	6,070	24.11	70.7	39.2	54.9	52	0.87	e.	.....
Toluca	8,812	.....	.....	.....	.....	.....	.....	.....	.....
Zacatecas	8,015	22.44	75.4	26.2	46.4	58	1.48	w.	.....
Zapotlan	5,078	25.05	77.5	40.6	58.1	66	6.13	se.	.....

*The monthly barometric means are reduced to the international standard of gravity.

Chart I. Tracks of Centers of High Areas, January, 1903. • Barkerville
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Chart I. Tracks of Centers of High Areas. January, 1903.

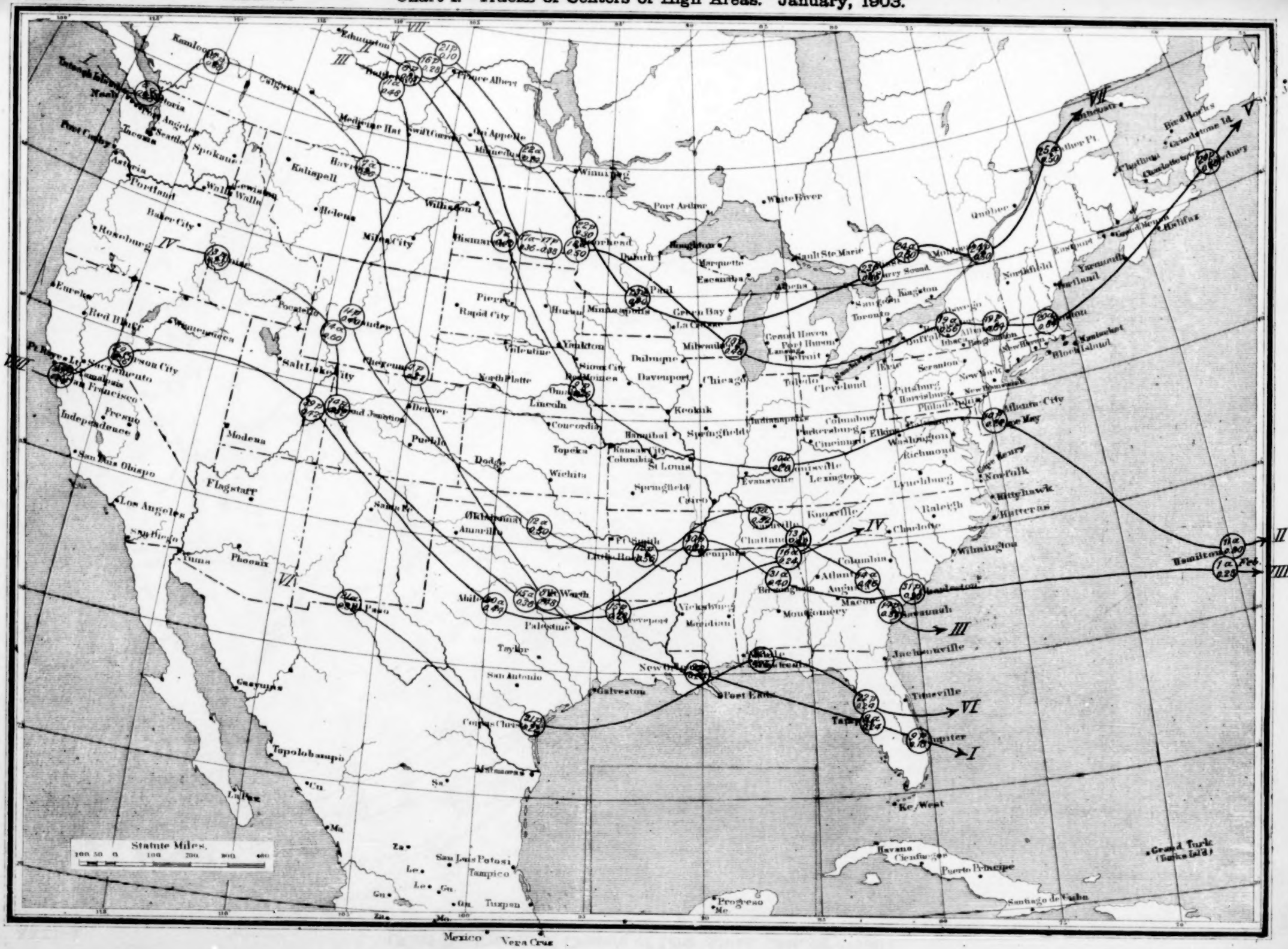

Chart II. Tracks of Centers of Low Areas. January, 1903.

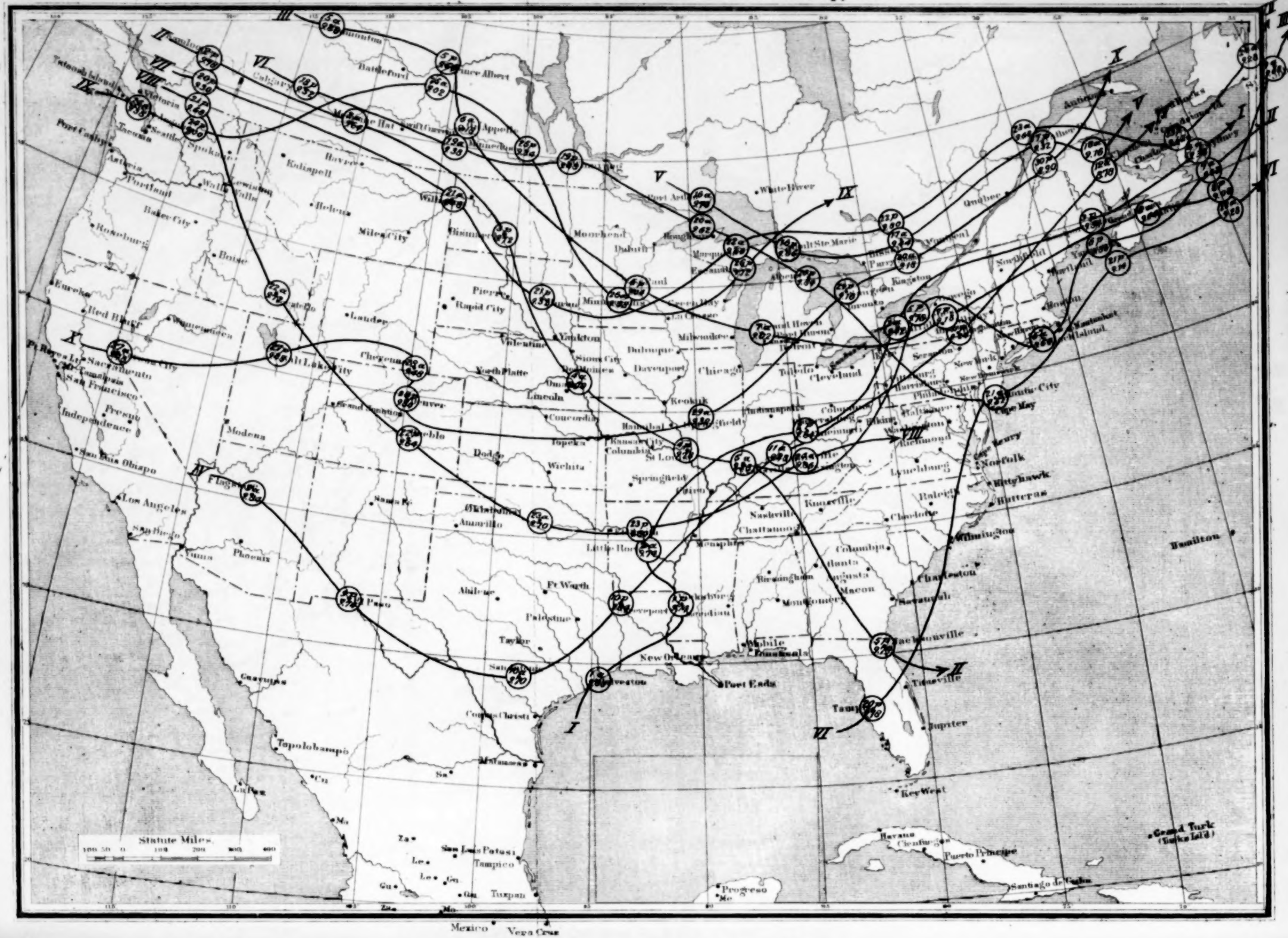

Chart III. Total Precipitation. January, 1903.

Chart III. Total Precipitation. January, 1903.

Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. January, 1903.

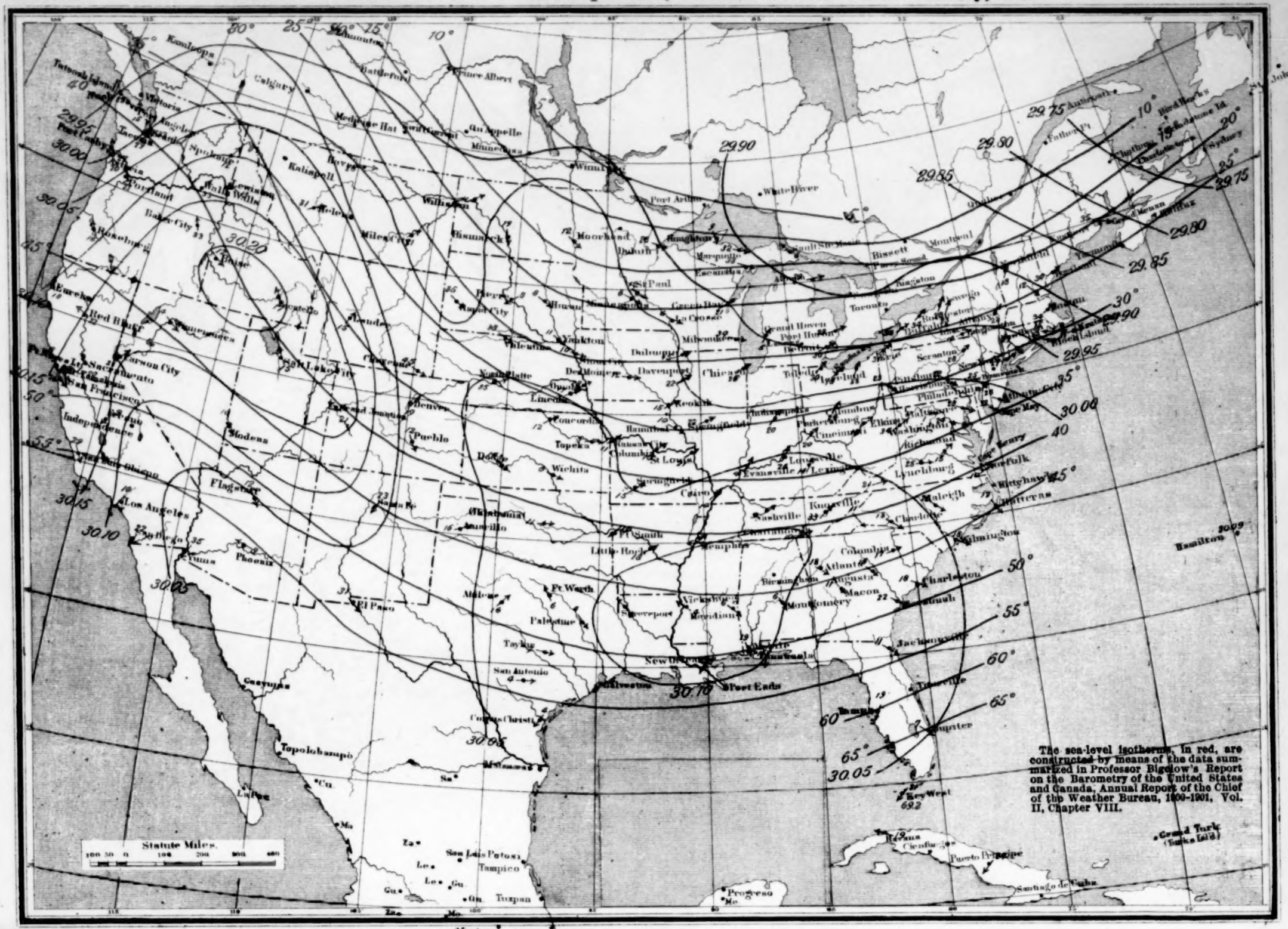
Statute Miles.
100 50 0 100 200 300 400
Mexico
Vera Cruz
Key West
692
Grand Turk
(Turks Isld)
Hamilton
30.09
The sea-level isotherms, in red, are constructed by means of the data summarized in Professor Bigelow's Report on the Barometry of the United States and Canada, Annual Report of the Chief of the Weather Bureau, 1900-1901, Vol. II, Chapter VIII.

 Chart V. Hydrographs for Seven Principal Rivers of the United States. January, 1903.

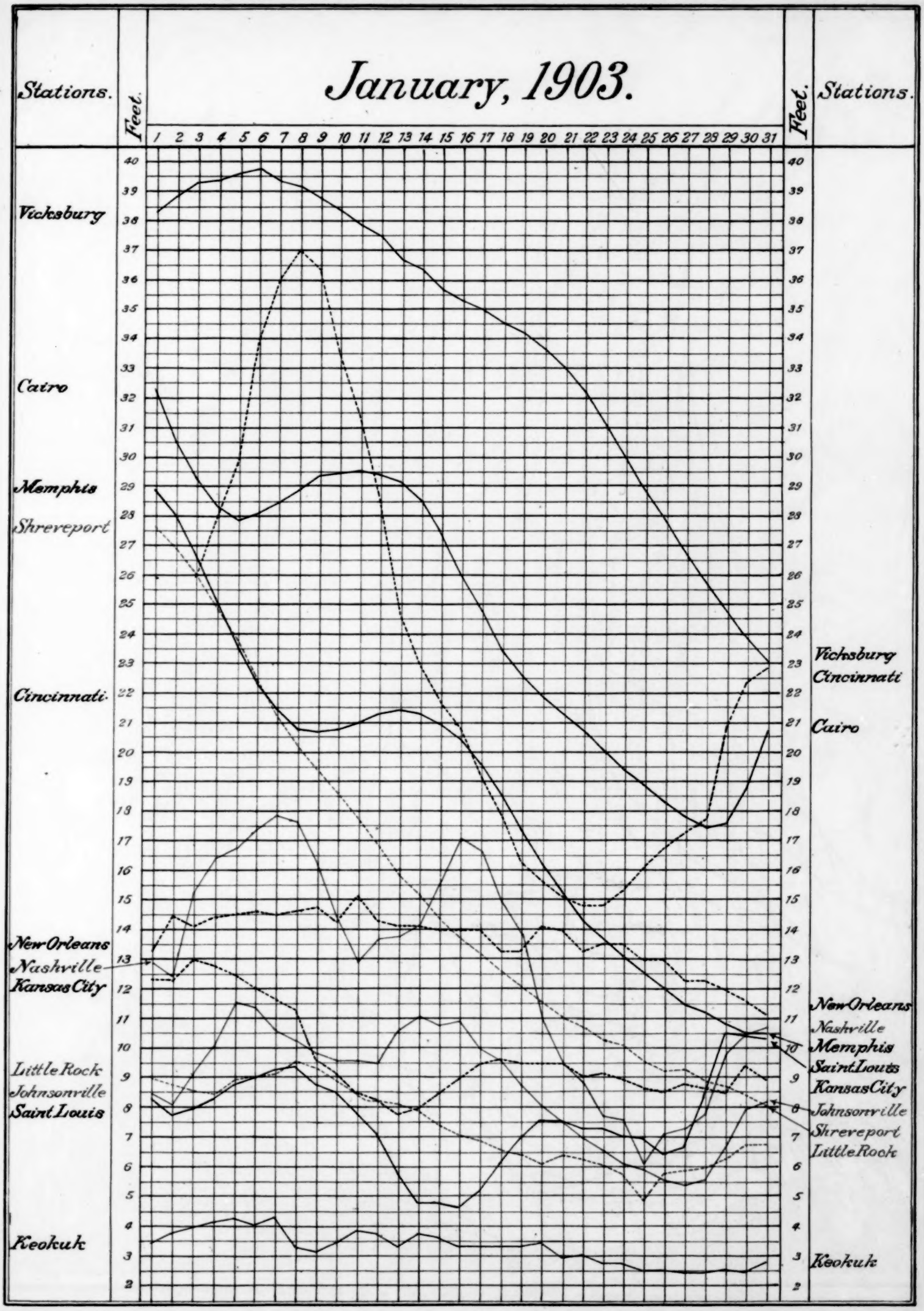

Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. January, 1903.

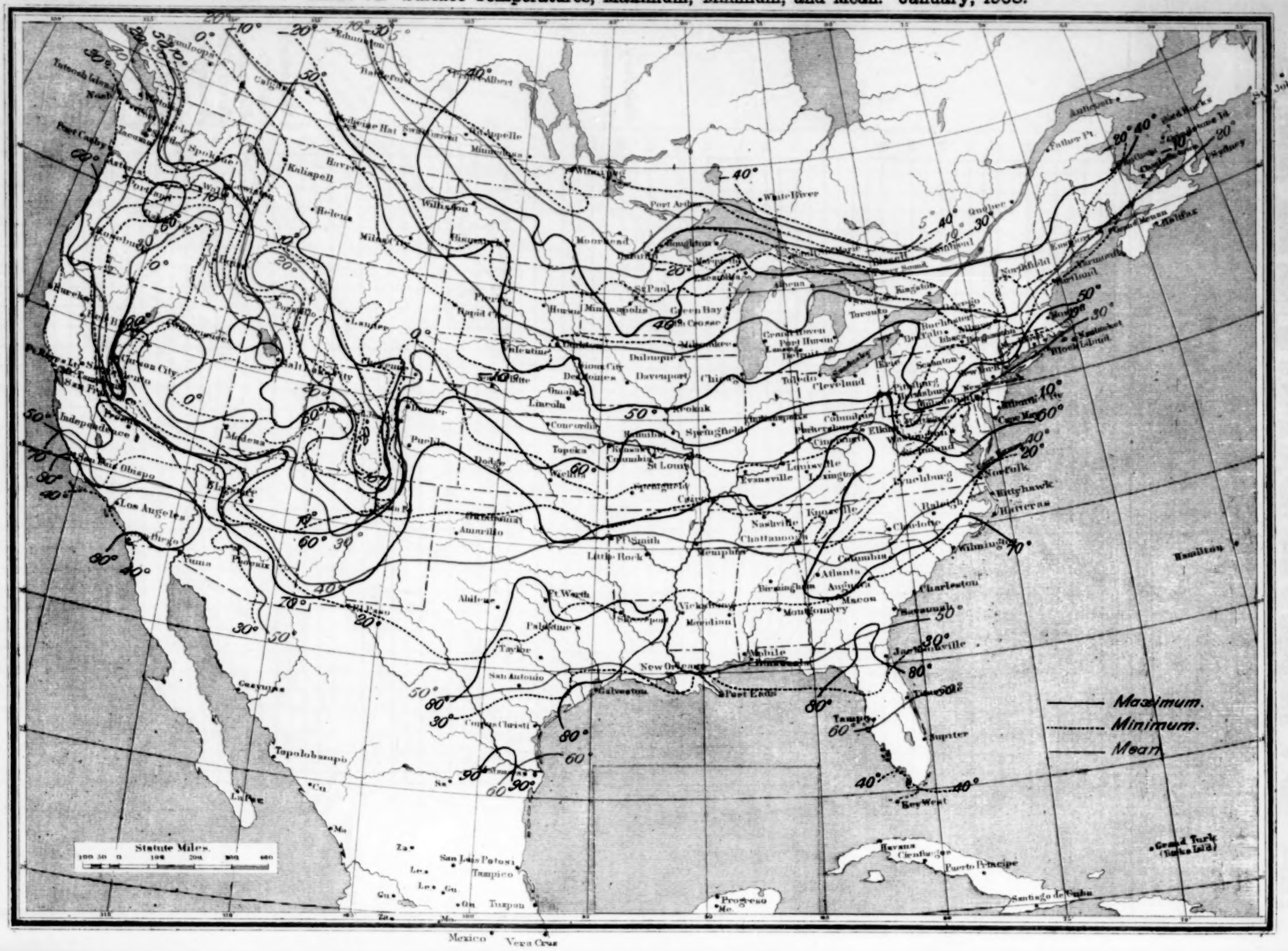

Chart VII. Percentage of Sunshine. January, 1903.

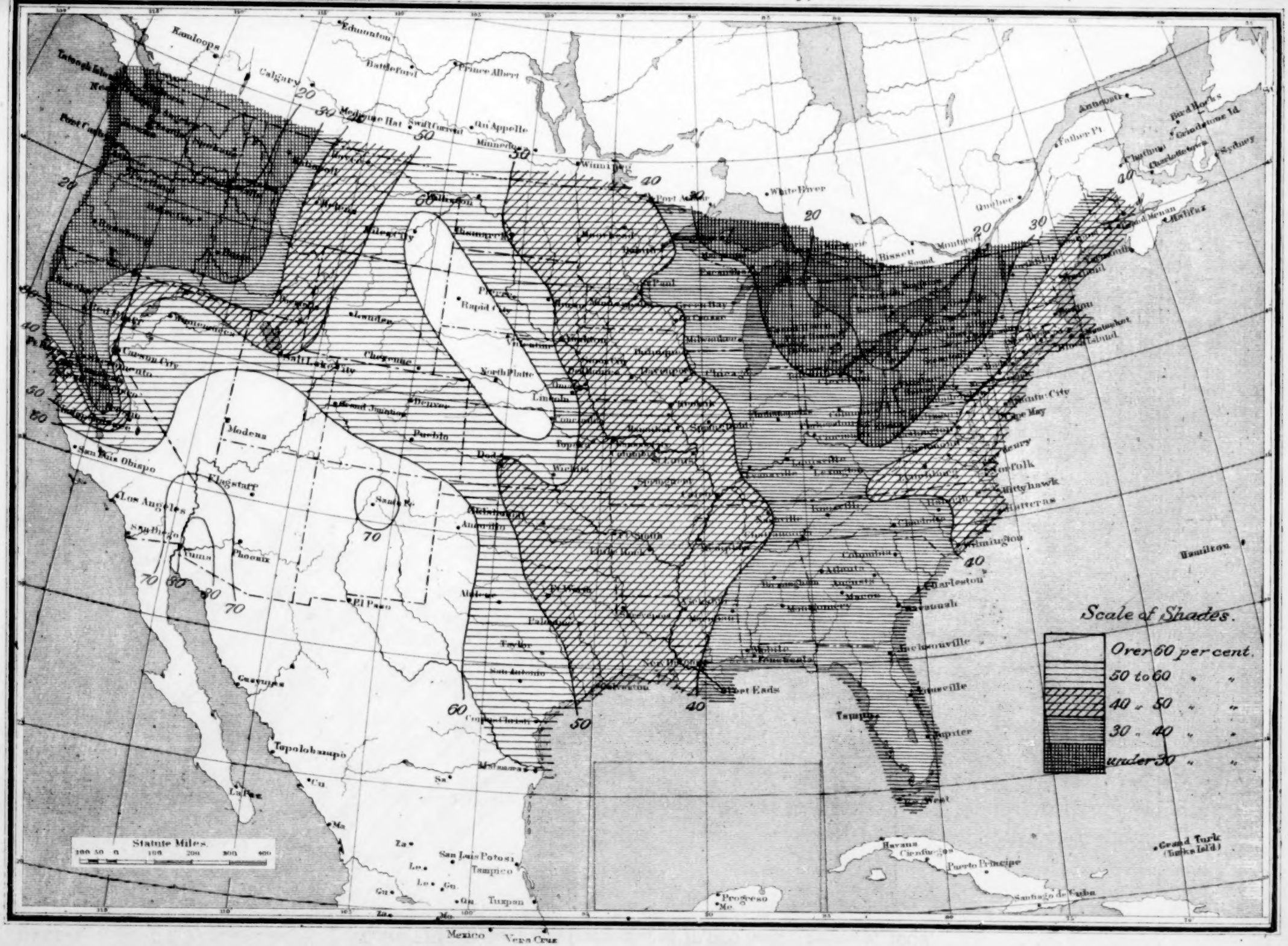

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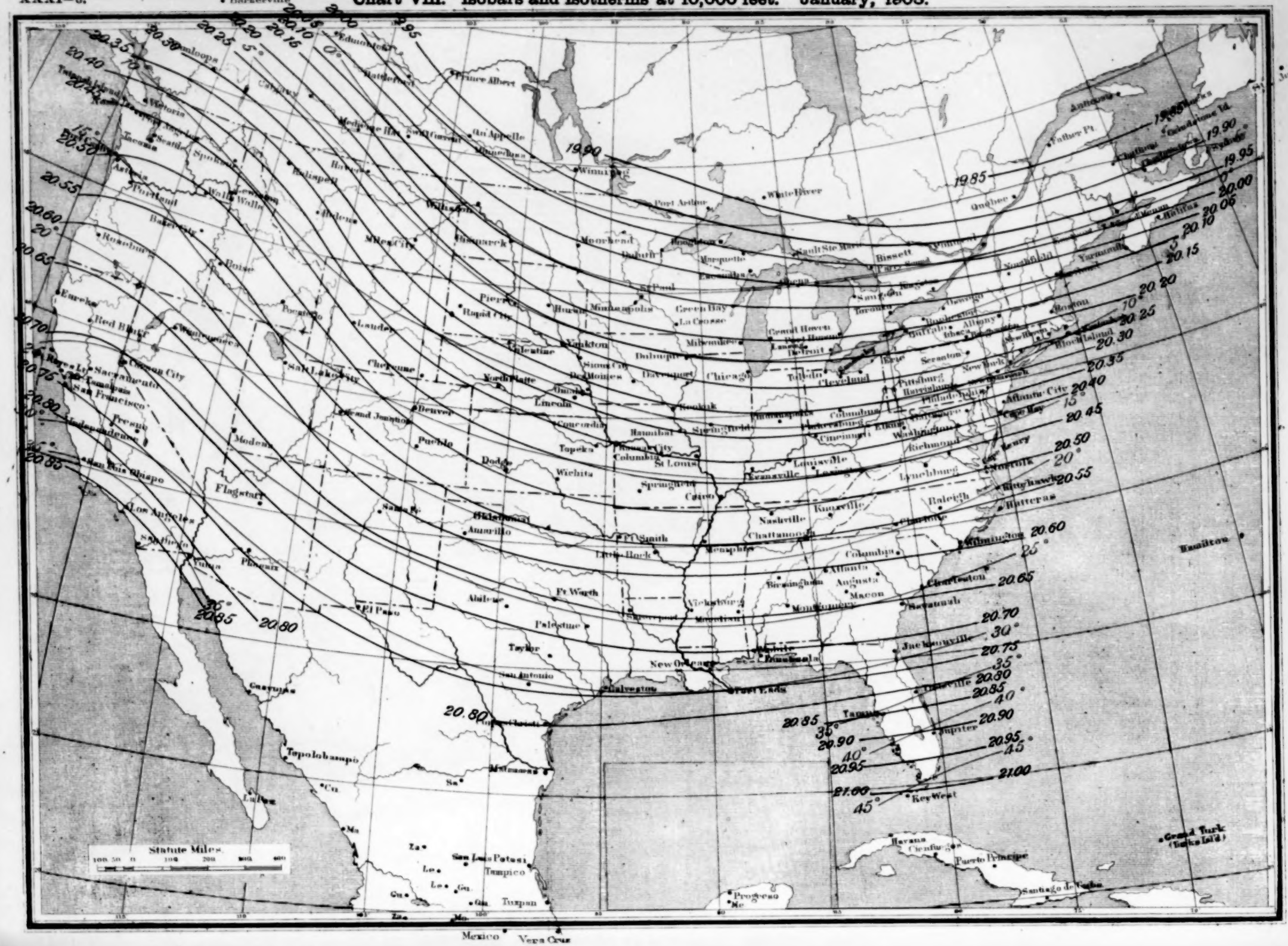
Chart VIII. Isobars and Isotherms at 10,000 feet. January, 1903.



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Barkerville

Chart IX. Isobars and Isotherms at 20,000 feet. January, 1903.

Chart IX. Isobars and Isotherms at 3,500 feet. January, 1903.

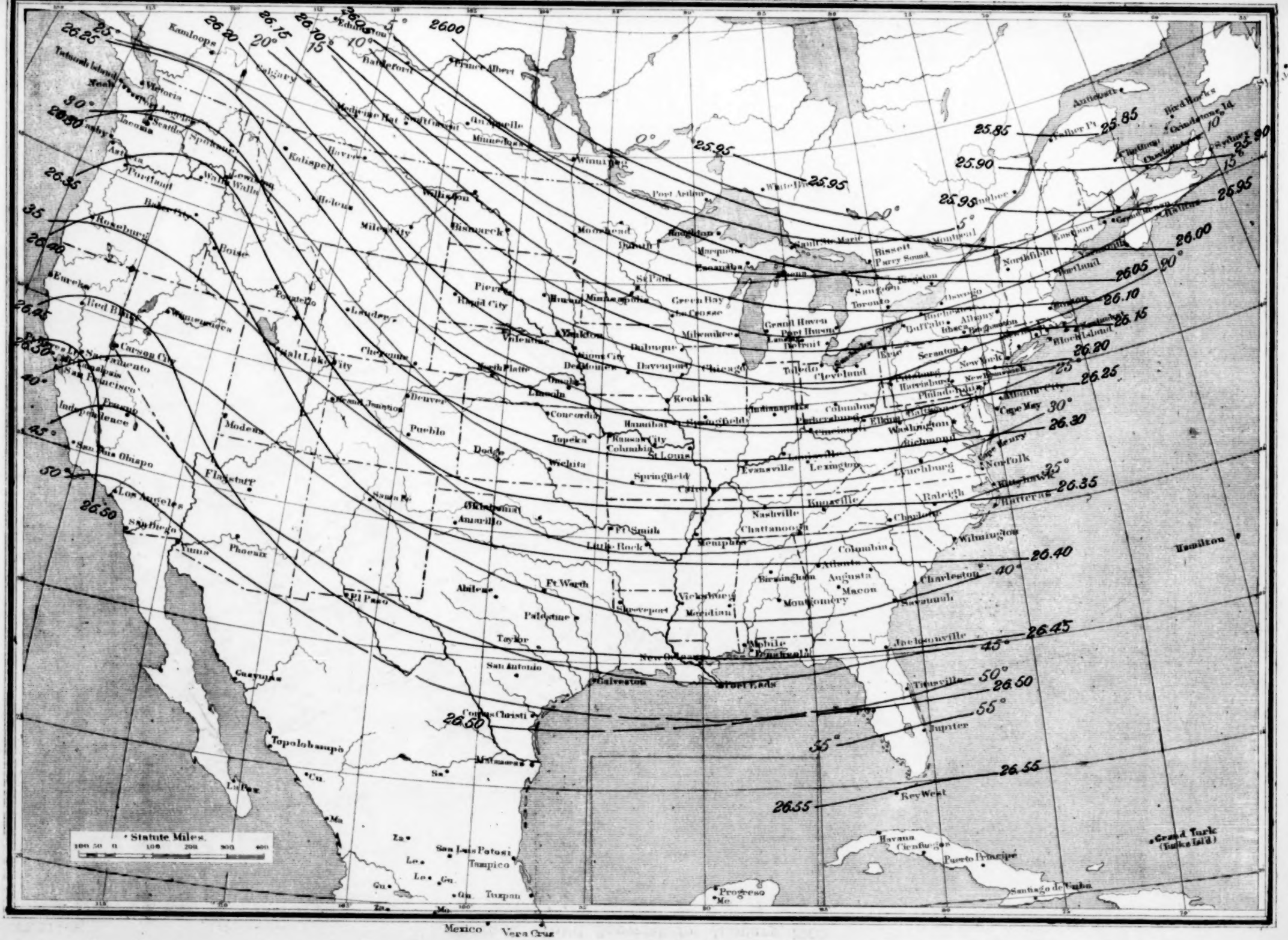

Chart X. Total Snowfall for January, 1903.

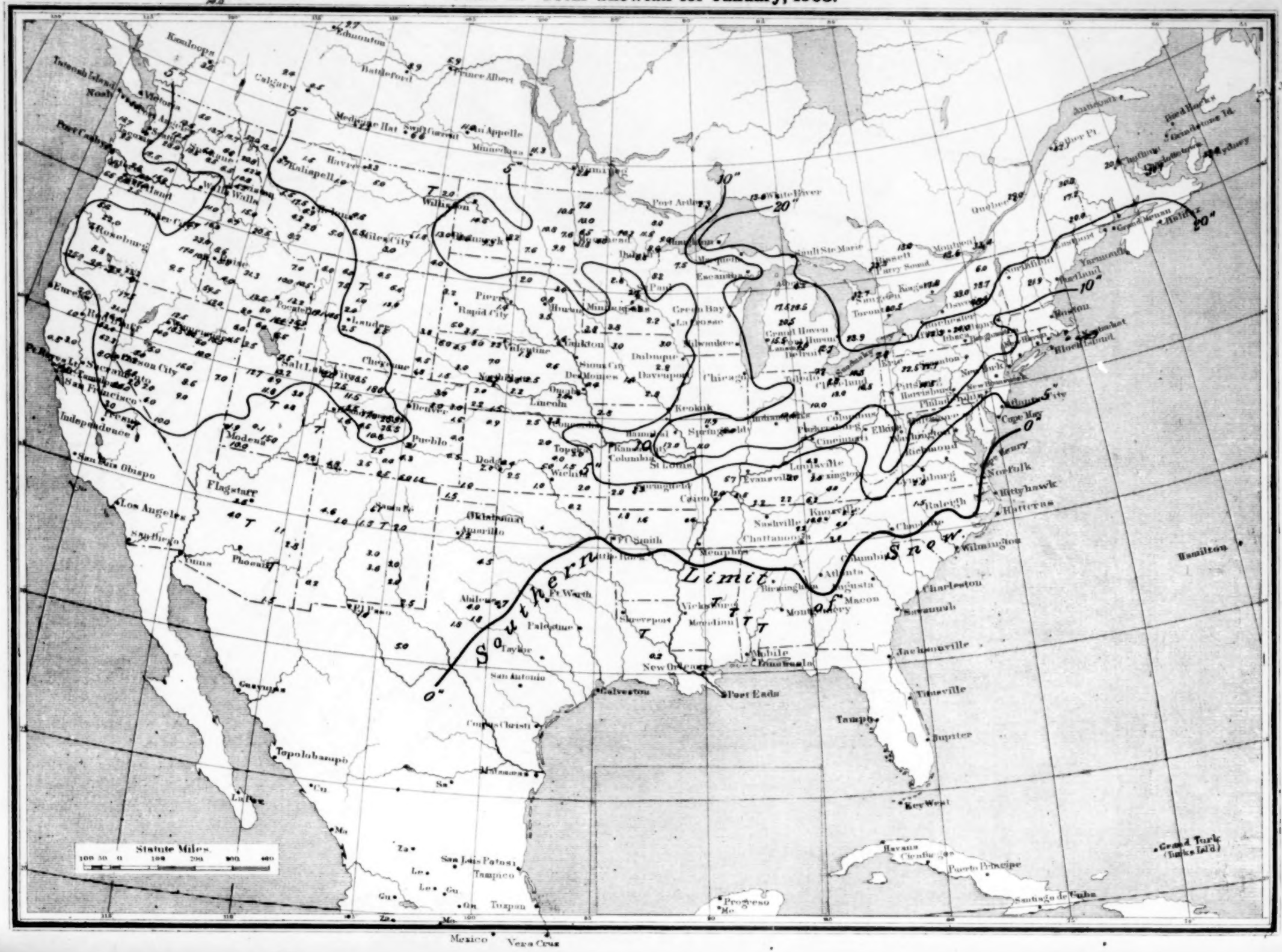
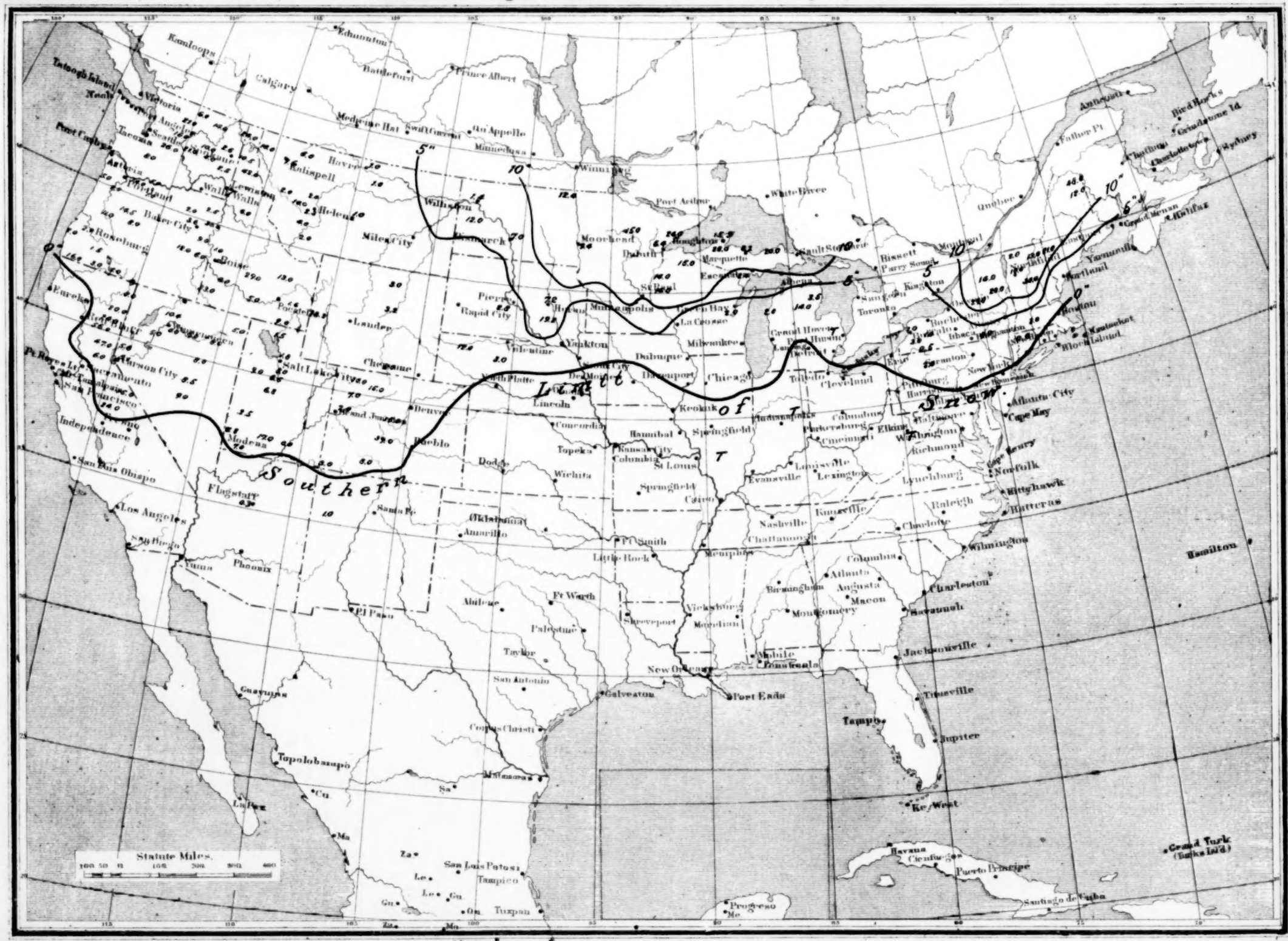
Chart XI. Depth of Snow on Ground on January 31, 1903.